AL/OE-CR-1995-0006

ARMSTRONG LABORATORY

WASTEWATER TREATMENT PLANT ENVIRONMENTAL STUDY, MACDILL AFB, FLORIDA

Michael F. Hewitt
Don Stern

Parsons Engineering Sciences, Inc.
57 Executive Park South N.E., Suite 500
Atlanta, GA 30329-2265

OCCUPATIONAL AND ENVIRONMENTAL HEALTH DIRECTORATE
BIOENVIRONMENTAL ENGINEERING DIVISION
2402 E Drive
Brooks Air Force Base, TX 78235-5114

October 1995

Final Technical Report for Period April - June 1995

Approved for public release; distribution is unlimited.

AIR FORCE MATERIEL COMMAND
BROOKS AIR FORCE BASE, TEXAS

NOTICES

This report is published as received and has not been edited by the staff of the Armstrong Laboratory.

Publication of this report does not constitute approval or disapproval of the ideas or findings. It is published in the interest of scientific and technical information (STINFO) exchange.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

Government agencies and their contractors registered with Defense Technical Information Center (DTIC) should direct requests for copies to: DTIC, Building #5, Cameron Station, 5010 Duke Street, Alexandria, VA 22304-6145.

Non-Government agencies may purchase copies of this report from: National Technical Information Services (NTIS), 5285 Port Royal Road, Springfield, VA 22161-2103.

CHRISTOPHER A. WILLISTON, Capt, USAF, BSC
Project Engineer, Water Quality Branch

for, JAMES D. MONTGOMERY, LtCol, USAF, BSC
Chief, Bioenvironmental Engineering Division

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	October 1995	Final, April - June 1995

4. TITLE AND SUBTITLE
Wastewater Treatment Plant Environmental Study,
McDill AFB, Florida

5. FUNDING NUMBERS
C - F33615-89-D-4003

6. AUTHOR(S)
Michael F. Hewitt
Don Stern

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Parsons Engineering Science, Inc.
57 Executive Park South N.E., Suite 500
Atlanta, Georgia 30329-2265

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Armstrong Laboratory
Occupational and Environmental Health Directorate
Bioenvironmental Engineering Division
2402 E Drive
Brooks Air Force Base, Texas 78235-5114

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
AL/OE-CR-1995-0006

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*
The Final Phase I Report contains the results of the MacDill AFB diagnostic evaluation conducted in April 1995 as part of the U.S. Air Force wastewater treatment plant environmental study program for improving the performance of wastewater treatment plants serving Air Force installations. The report provided the details of the Phase I findings, conclusions, and all recommendations. The report is broken down into nine sections including an introduction, plant description, staffing and management, plant operations/process control, maintenance, laboratory and sampling, record keeping, safety, and conclusion and recommendations.

14. SUBJECT TERMS
Wastewater, activated sludge, laboratory, maintenance, safety, process control

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-18
298-102

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

LIST OF TABLES

PREFACE

This report is a record of actions taken at MacDill Air Force Base, Florida, under the Wastewater Treatment Plant Environmental Study Program for the purpose of improving the performance of the wastewater treatment plant (WWTP) serving the installation.

During Phase I of the project, an on-site evaluation was made at MacDill AFB by a team composed of personnel from Parsons Engineering Science, Inc. (Parsons ES).

EXECUTIVE SUMMARY

The Wastewater Treatment Plant Environmental Study Program is a major program designed to correct operational and maintenance shortcomings at U.S. Air Force base wastewater treatment plants. This is a three-phase program, as outlined below:

- Phase I - On-site diagnostic evaluation of a WWTP to identify shortcomings and determine what assistance is needed to correct them.
- Phase II - Preparation of a plant-specific Operation and Maintenance Manual and on-site implementation and support for improving O&M, sampling and lab testing.
- Phase III - On-site verification and benefit analysis to assess the effectiveness of assistance provided during Phase I and Phase II.

The Phase I site visit was conducted in April 1995. At the time of the visit, the MacDill AFB WWTP was generally a well operated facility. The major compliance issue related to the MacDill WWTP operation is the plant's current inability to meet the requirements of the EPA Part 503 Biosolids Rule regarding land application of sludge. This is a major problem in terms of time and capital required to meet the requirements in order to continue land applying sludge. A program to address this problem needs to initiate as soon as possible. The plant process operation had some problems and it was the consensus of the evaluation team that the strategy for operating the activated sludge system should be more clearly defined. Furthermore, there were several other unit process operations that need to be established or amended to ensure their effectiveness. Discharge data indicates that the WWTP has had three instances of exceeding permit limitations during the fourteen months preceding the Phase I evaluation. These exceedences were for minimum chlorine residual permit limitations. The plant had just undergone an upgrade which was completed in March 1995. The exceedences were prior to the plant upgrade. Key recommendations of the Phase I Report include initiating a program to meet the requirements of the EPA Part 503 Biosolids Rule for Land Applicaiton of Sludge, implementing a plant process control strategy based on maintaining a constant sludge retention time, implementing additional remote monitoring at lift stations, making improvements in grit and screenings handling systems, correcting

sampling procedures to meet permit requirements, making filter modifications, improving process control testing of the digesters, making renovations to the effluent sprayfield, making modifications to the secondary digester piping, improving existing operator training opportunities and staffing efficiency, improving maintenance record keeping, implementing an instrumentation calibration/maintenance contract and purchasing additional safety equipment. A total of 42 recommendation were made as a result of the Phase I evaluation.

The format of the Phase I report generally follows that provided in *A Guide to the Department of Defense Operation, Maintenance and Training Assistance Program (OMTAP) for Wastewater Treatment Plant Personnel,* June 1987. In addition, reference to particular points in the scope of work are included after pertinent discussions throughout the report.

The initial Phase II visit to MacDill AFB is scheduled for May 10, 1995.

SECTION 1
INTRODUCTION

1.1 DESCRIPTION OF WASTEWATER TREATMENT PLANT ENVIRONMENTAL STUDY

The wastewater treatment plant environmental study is an outgrowth of the OMTAP (Operation, Maintenance and Training Assistance Program), a Department of Defense program designed to improve the performance of wastewater treatment plants located on military installations. The program is divided into three phases, each requiring visits to the treatment facility by a team of evaluators.

As the program is currently designed, the first phase involves a comprehensive diagnostic evaluation of the treatment processes to identify operational and/or design deficiencies. During this site visit, the evaluation team members conduct a comprehensive process evaluation and collect information needed to produce a draft of an operation and maintenance (O&M) manual for the plant. Reviews of operations, maintenance, and laboratory procedures are conducted. Evaluation of plant records and permit compliance are also conducted.

The second phase involves up to four site visits to conduct implementation and support for operators on procedures recommended to overcome those problems identified during the diagnostic phase. The visits occur over several months after the program is initiated at an Air Force installation. The team also validates the content of the draft O&M manual and examines operational problem areas in more depth.

The third phase, which occurs 6 to 12 months after the initial site visit, is a follow-up verification of plant performance to assess those improvements that have been made since the program was initiated and the benefits accrued. If needed, additional assistance that might benefit plant operators is provided.

1.2 PURPOSE OF PHASE I VISIT

The Phase I visit was conducted to perform an on-site diagnostic evaluation of the MacDill Air Force Base wastewater treatment plant (WWTP). The purpose of the visit

was to provide site-specific assistance to the WWTP staff to identify and correct deficiencies and less than optimum practices and procedures.

The Phase I on-site diagnostic evaluation of the WWTP was conducted during the period of April 3-7, 1995. Members of the Parsons ES Team included:

- Mike Hewitt- Parsons ES Project Manager
- Don Stern - Parsons ES Project Engineer

A kickoff meeting was held on the morning of April 3, 1995. An initial tour of the WWTP was conducted on the morning of the same day. Minutes of the kickoff meeting were provided in Letter Report No. 1, dated April 13, 1995.

During the period of April 3-7, 1995, the ES team members evaluated the operation and maintenance of the treatment facility. Several informal meetings were held between Parsons ES team members and plant personnel. Particularly involved in assisting the team members were:

- Mr. Gene Svitak, WWTP Superintendent
- Mr. Bill Combs, Chief Industrial Mechanic
- Mr. Ted Mahala, Plant Operator
- Mr. Jay Schwartz, Industrial Mechanic
- Mr. Richard Burnette, Civil Engineering Squadron
- Mr. Mike Cawley, Civil Engineering Squadron

An exit briefing was held on the morning of April 7, 1995. The meeting was presided over by Mr. Bill Campbell, Deputy Base Civil Engineer. A summary of the Phase I site visit and initial recommendations were presented by the ES team. Summary recommendations were documented in Letter Report No. 2, dated April 13, 1995.

1.3 ACCOMPLISHMENTS OF PHASE I VISIT

During the Phase I visit, the evaluation team made a number of significant accomplishments. The major accomplishments include:

- Diagnostic evaluation of each unit treatment process.
- Evaluation of operating strategy.

- Evaluation of sampling, laboratory procedures and analytical equipment.
- Evaluation of physical condition of plant and equipment.
- Evaluation of preventive maintenance and safety programs.
- Evaluation of plant record keeping systems.
- Evaluation of operator job skills, certification levels, and training.
- Evaluation of management structure for the WWTP.
- Evaluation of the effect of nondomestic discharges on the WWTP.
- Inspection and evaluation of key remote lift stations.
- Collection of information for the O&M manual
- Evaluation of sludge disposal requirements.

1.4 INSTALLATION OVERVIEW

MacDill AFB is located in west central Florida at the southern tip of the Interbay Peninsula in Hillsborough County. The base is bordered by Tampa Bay on the south and west sides, Hillsborough Bay on the east side and the city of Tampa on the north side as shown in Figure 1.1. The MacDill AFB property comprises 5,638 acres of land, most of which is built up from dredged materials. The topography is generally flat with most developed area elevations between five and 10 feet above mean sea level.

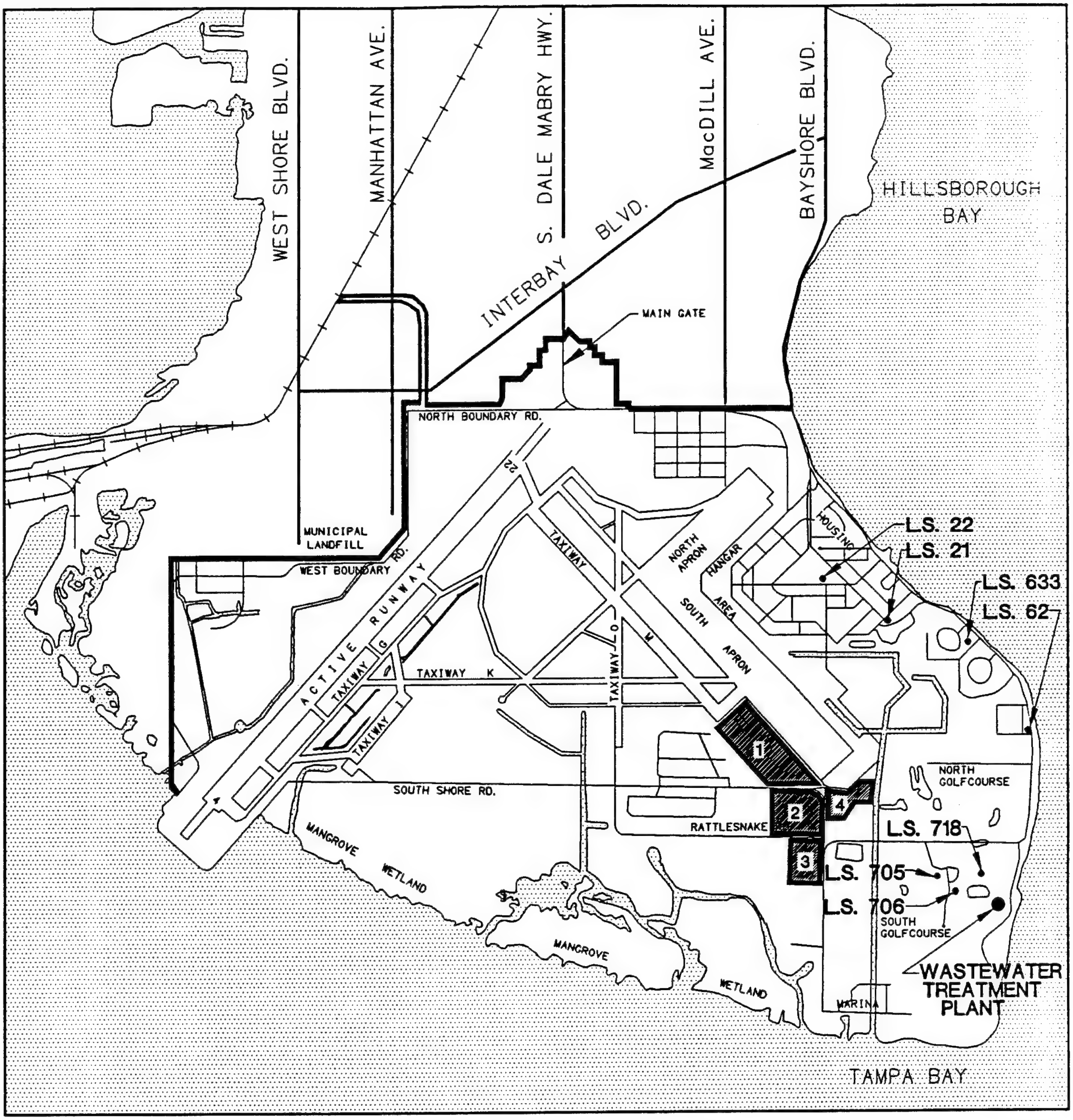
MacDill AFB is the home of U.S. Central Command and U.S. Special Operations Command, two of the six unified commands in the United States. In the spring of 1994, the 56th Fighter Wing left MacDill AFB for other missions in other locations. The base no longer supports a fighter wing mission and has undergone extensive realignment since the March 1994 partial closure date.

Recently, aircraft and support staff from the National Oceanic and Atmospheric Administration (NOAA) have begun operation at MacDill AFB.

The wastewater service area at MacDill AFB contains relatively few industrial operations or facilities. It is estimated that less than one percent of the wastewater received at the WWTP is from industrial sources.

The MacDill AFB WWTP and wastewater pumping stations are operated by civilian (Federal Civil Service) personnel. The wastewater treatment plant is located in the

Figure 1.1



EXPLANATION

AREA BOUNDARY
ROADS
IRRIGATION FIELD
OPEN WATER
L.S. # MAJOR LIFT STATION

0 1000 3000 FEET

WASTEWATER FACILITIES

MacDILL AFB, FLORIDA

C:\72101\2\012-MAC, 04/25/95 at 08:56, PAE, 1=1

southeastern portion of the base, and serves the eastern half of the base, the flight line area and a small portion of the western half of the base. The remainder of the western half of the base, which has much lower population densities and fewer facilities, is not connected to the plant but is served by two wastewater treatment package plants with drain fields and numerous septic systems consisting of septic tanks and drain fields. The highly treated effluent (reclaimed water) from the treatment plant is used for spray irrigation on the two base golf courses and a spray irrigation field.

There are 49 wastewater lift stations located on the base, which either "lift" the wastewater to flow by gravity in the collection system or pump under pressure in a force main system to the WWTP. Seven of the stations are considered to be major lift stations, by virtue of the flow received and the size and number of the pumps at the station.

1.5 OPERATING PERMIT REQUIREMENTS

A primary objective of this WWTP Environmental Study is to ensure that the operation of the WWTP maintains compliance with the Florida Department of Environmental Regulation Reclaimed Water Permit (DO29-222584). The MacDill AFB WWTP discharges to a reclaimed water holding pond and golf course holding pond then to irrigation on two base golf courses and a spray irrigation field. The Permit discharge limitations are presented in Table 1.1.

In addition to the limitations presented in Table 1.1, important operating requirements which should be kept in mind and followed are summarized below:

1. The water quality standards for Class G-II groundwater shall not be exceeded at the boundary of the zone of discharge.
2. The required certified operator and on-site time is a Class C or higher operator, 16 hours per day, seven days per week. The lead chief operator must be Class B or higher.
3. The plant influent must be monitored biweekly and reported monthly along with effluent data on DER Form 17-601.900(1) to the local Southwest District Office of the Department of Environmental Regulation and the Environmental Protection Commission of Hillsborough County.
4. The permittee shall monitor the effluent turbidity before disinfection and monitor total chlorine residual after disinfection and before pumping to the reclaimed water system storage or to the reuse system. Monitoring shall be on a

Table 1.1
MacDill AFB WWTP
Reclaimed Water Permit Limitations

Parameter	Units	Minimum	Maximum
Flow	MGD		1.2
pH	Std. Units	6.0	8.5
CBOD	mg/l		20 annual avg.
CBOD	mg/l		30 monthly avg.
CBOD	mg/l		45 weekly avg.
Nitrate	mg/l		12.0
Chlorine	mg/l	1.0	
Total Suspended Solids	mg/l		5.0
Fecal Coliform Bacteria	#/100 ml	Non-detect (75% of samples)	25

continuous (on-line) basis and shall include an alarm system to indicate failure of high-level disinfection prior to system storage or to the reclaimed water reuse system. Instruments for continuous on-line monitoring of the turbidity and disinfectant residual shall be routinely calibrated and maintained.

5. The domestic wastewater residuals shall be sampled after final treatment but prior to land application for the parameters listed below every 3 months. A copy of the analyses shall be submitted with the monthly operation report for the following parameters.

Total Nitrogen	% dry weight
Total Phosphorus	% dry weight
Total Potassium	% dry weight
Cadmium	mg/kg dry weight
Copper	mg/kg dry weight
Lead	mg/kg dry weight
Nickel	mg/kg dry weight
Zinc	mg/kg dry weight
pH	standard units
Total Solids	%

6. The permittee shall ensure that neither ponding nor run-off from the spray site occurs as a result of the spray irrigation of the wastewater. Direct discharge from the Golf Courses, sprayfields or the holding ponds to area surface waters is not allowed. Surface discharge shall be considered a violation of this permit and the permittee shall immediately report any such discharge to the SW District Office of the Department of Environmental Protection.

7. The permittee shall provide an approved flow measurement device on the WWTP effluent equipped with a recorder and an integrator or totalizer. The flow measurement device shall be calibrated at least annually, with evidence of calibration kept at the site of flow measurement, and submitted to the Department upon request.

8. The permittee shall properly operate and maintain the facility and systems of treatment and control (and related appurtenances) that are installed and used by the permittee to achieve compliance with the conditions of this permit, are required by Department rules. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to achieve compliance with the conditions of the permit and when required by Department rules.

9. If, for any reason, the permittee does not comply with or will be unable to comply with any condition or limitation specified in this permit, the permittee shall immediately provide the Department with a description of and cause of noncompliance and the period of noncompliance, including dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate, and prevent recurrence of the noncompliance.

10. The permittee shall hold at the facility or other location designated by this permit records of all monitoring information (including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation) required by the permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit. These materials shall be retained at least three years from the date of the sample, measurement, report, or application unless otherwise specified by Department rule.

11. Records of monitoring information shall be maintained including the following:
    - the date, exact place, and time of sampling or measurements;
    - the person responsible for performing the sampling or measurements;
    - the dates analyses were performed;
    - the person responsible for performing the analyses;
    - the analytical techniques or methods used;
    - the results of such analyses.

1.6 SLUDGE LAND APPLICATION

The MacDill WWTP is permitted to land apply digested sludge at Hudson Farms in Charlotte and DeSoto Counties. The permit contains requirements for monitoring of sludge, as discussed in Section 1.5.

The land application of sludge from the MacDill AFB WWTP appears to be a major compliance deficiency at the present time. Sludge from the MacDill WWTP is processed through two uncovered, unheated digestion tanks. The EPA Part 503 Biosolids Rule and the pending Florida Administrative Code (FAC) Chapter 62-640 Residuals Management Rules require that biosolids meet pathogen and vector attraction reduction requirements

prior to land application. The facility's permit classifies the MacDill WWTP biosolids as stabilization Class B residuals. Under the proposed Florida rules, Class B residuals must undergo treatment in a Process to Significantly Reduce Pathogens (PSRP). The anaerobic digesters at MacDill AFB WWTP do not meet the requirements for a PSRP due to the Mean Cell Residence Time (MCRT) requirements (60 days @ 20°C) or 15 days at 35° - 55°) and temperature requirements. Under 503, Class B pathogen reduction requirements are identical for anaerobic digestion. In addition, under 503 Rules a vector attraction reduction alternative must also be met and it is uncertain, based on available data if the MacDill WWTP could meet any of the available vector attraction alternatives. In addition, EPAs guidance on Anaerobic Digestion as a pathogen reduction technology defines anaerobic digestion as taking place in a covered tank. The fact that the units at MacDill are not covered precludes their being considered as a viable pathogen reduction alternative.

An important aspect of the Part 503 Biosolids Rule that must be kept in mind is that the Rule is self-implementing. Essentially, this means that regardless of whether a permit has been issued by the EPA, the state or local authority, the requirements of the rule are still in force. At present, MacDill AFB is technically in violation of this Federal Rule by land applying sludge that does not meet the requirements discussed above, even though the state or Hillsborough County have not issued their requirements as yet.

SECTION 2
PLANT DESCRIPTION

2.1 GENERAL

The MacDill AFB WWTP is a biological treatment process achieving advanced treatment levels capable of meeting the Florida reclaimed water requirements through tertiary filtration and disinfection. The plant was originally designed and constructed in 1952 as a primary treatment facility and in 1969 was converted to a secondary plant. The latest modification occurred in 1993-94 with the addition of new headworks equipment, including an automatic bar screen and grit removal system, addition of a new flow equalization tank, modifications to the main pump station within the plant, a new chlorine contact tank and effluent pumping system, aeration system modification and improvements to the digesters.

2.2 WASTEWATER CHARACTERIZATION

The plant influent is primarily domestic and, although the industrial waste flow is not monitored, it is estimated that less than one percent of the wastewater is from industrial contributions. The influent wastewater to the treatment plant is characterized by an average carbonaceous biochemical oxygen demand (CBOD) of 113 mg/l with a range from a low of 40 mg/l to a high of 317 mg/l. Influent total suspended solids (TSS) averaged 76 mg/l with a low of 22 mg/l and a high of 106 mg/l. These data were compiled from the period January 1994 through February 1995 These values are not consistent with average, high and low values for influents to domestic wastewater plants in the United States. The low influent loading could be a function of dilution due to infiltration and inflow of stormwater and groundwater into the collection system.

The wastewater treatment plant is receiving an average influent flow of 0.566 million gallons per day (mgd). The range for daily influent flow during the period January 1994 through February 1995 was a high of 1.542 mgd and a low of 0.114 mgd. The average hydraulic loading to the WWTP is within the present design capacity of 1.2 mgd.

2.3 KEY TREATMENT PROCESSES

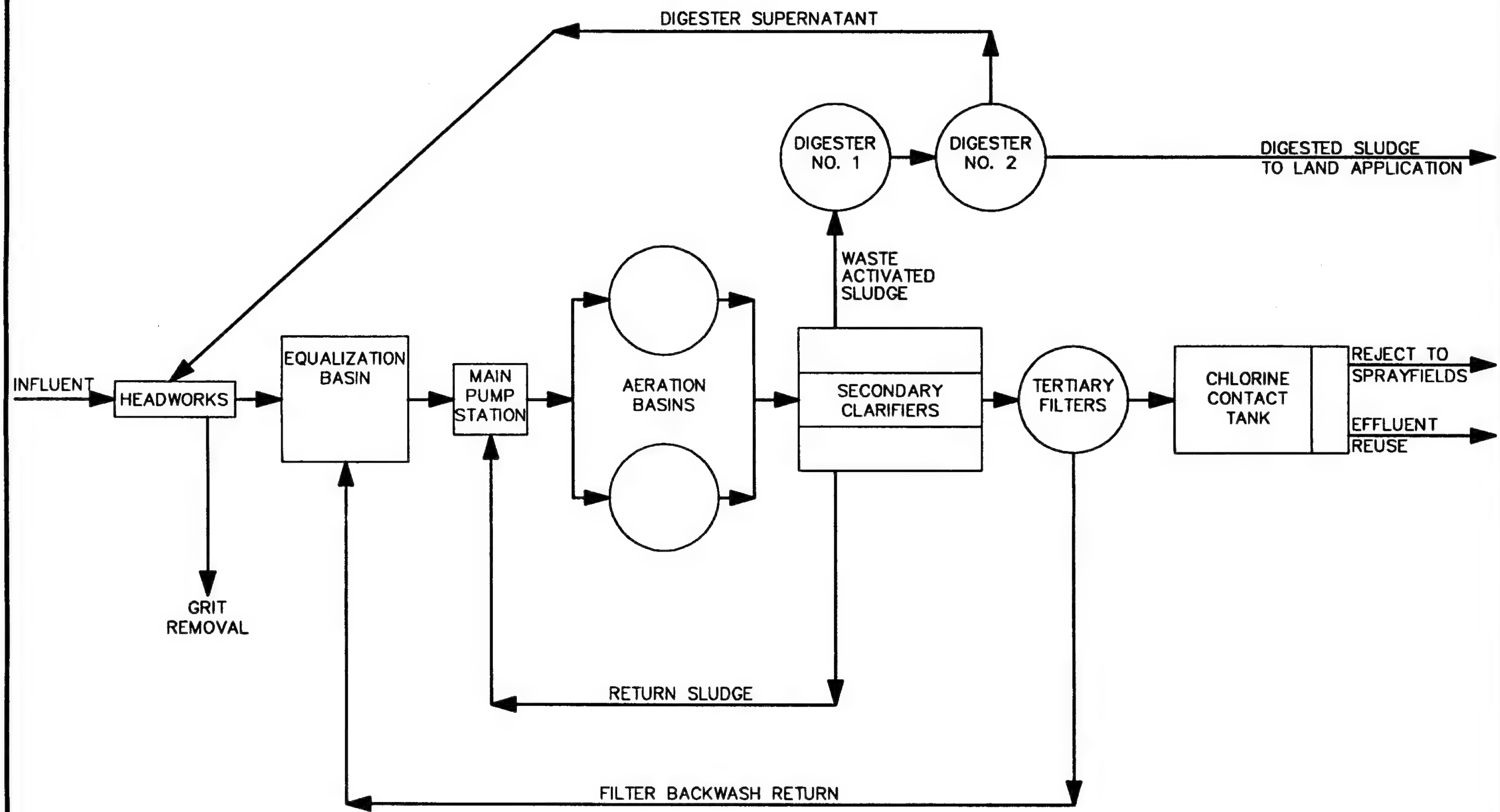
The MacDill AFB WWTP is a biological treatment system employing the activated sludge process. The key unit processes are:

- Screening
- Grit Removal
- Equalization
- Biological Treatment (Activated Sludge)
- Secondary Clarification
- Tertiary Filtration
- Disinfection
- Effluent Spray Irrigation
- Anaerobic Sludge Digestion
- Sludge Land Application

2.4 FLOW SCHEMATIC DIAGRAM

Figure 2.1 presents a schematic diagram of the MacDill AFB WWTP. Major plant unit processes and flow streams are identified in the schematic.

MACDILL AFB WWTP FLOW SCHEMATIC



J.\721012\CADD\PFD-1, 04/27/95 at 16:10

PARSONS ENGINEERING SCIENCE, INC.

SECTION 3
PLANT STAFFING AND MANAGEMENT

3.1 PLANT STAFFING LEVEL AND ORGANIZATION

Currently the MacDill AFB WWTP is staffed by one WWTP Superintendent, four WWTP Operators and three Industrial Mechanics. These eight positions are all full-time civilian positions. There is also one military operator assigned to the group. The overall management of the WWTP is directed by the Superintendent of the WWTP. In his absence, the Chief Industrial Mechanic serves as acting superintendent of the WWTP. Above the WWTP positions is the Chief of the Operations Branch of the Civil Engineering Squadron. An organizational chart for the WWTP is provided in Figure 3.1. The staff described is responsible for staffing the plant 16 hours per day, seven days per week. Most of the laboratory analyses required for permit compliance are contracted out. A small amount of in-house lab work is performed by the plant staff for process control purposes. In addition to the wastewater treatment plant and laboratory, the O&M personnel are responsible for approximately 50 lift stations, 2 water booster stations, 2 ground storage tanks, 2 elevated storage tanks, grounds and building maintenance, 2 package plants and disposal of trash from arriving overseas aircraft. For six months of the year the WWTP staff is responsible for the operation and maintenance of the two base swimming pools. The military position allocated to the plant is available only approximately 10 percent of the time to WWTP O&M activities.

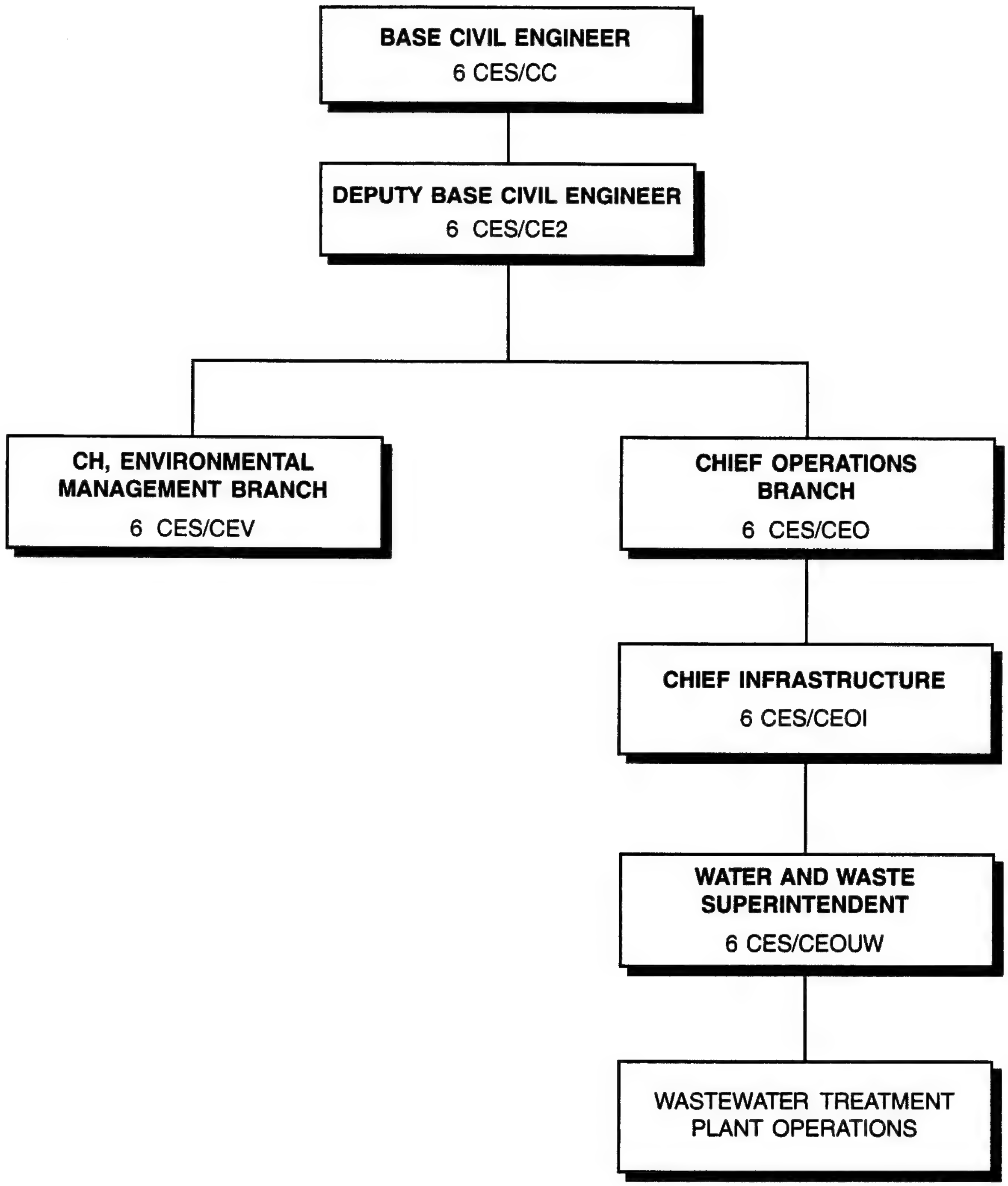
It is estimated that duties outside the WWTP require time approximately equivalent to one full time civilian person based on the aforementioned duties. This results in an approximate available manpower of seven full-time persons for the wastewater treatment plant.

3.2 OPERATOR DUTIES

The plant operators are all required to perform operational duties and minor maintenance functions. In addition, some operators also perform minor, routine sampling and laboratory functions. The majority of scheduled preventive maintenance and equipment repairs is performed by the Industrial Mechanics.

Figure 3.1

MACDILL AFB WWTP ORGANIZATIONAL CHART



G/725689/OC-2/PM5/0495

During Phase I, the ES evaluation team observed the plant operators in the execution of routine O&M and laboratory tasks. The operators performed their duties in an effective manner. The execution of routine duties was carried out in a manner dictated by operator experience. Operating guidance and standard operating procedures are available at the plant in the Plant Standard Operating Procedures and the current Operations and Maintenance manual. Process control strategies discussed in the SOPs and O&M manual have been utilized to control the activated sludge process in the past but there is not a unified strategy proposed in these documents to control the process. Also, at present, there was not evidence to indicate that these documents were being utilized to any great extent. Individual operators tended to operate by their own experience. The plant has detailed procedures available for all components of sampling and laboratory analyses. Laboratory analyses procedures are available for all parameters for which the lab is currently performing analyses. In the area of operations, a detailed operational log should be developed for items that need to be performed on each shift including a schedule of plant items to be checked, readings to be taken, samples to be collected and tests to be conducted. Currently a chronological log book is being utilized to record O&M activities but it does not provide specific action items to be carried out. An operational log would serve as an excellent format to direct operations staff on items to be completed on each shift. Some of the information within current procedures could be adapted to a O&M log format. This approach will be further explored and developed for the O&M Manual. (1.4.12)

3.3 CERTIFICATION REQUIREMENTS

The MacDill AFB WWTP is an activated sludge wastewater treatment plant within the State of Florida and as such, must comply with the rules of the Florida Department of Environmental Protection (FDEP). FDEP, in the reclaimed water permit issued to MacDill AFB, requires that the WWTP be staffed by Class C certified operator 16 hours per day, 7 days per week. A plant is also required to have Class B domestic plant operator in charge. The WWTP meets these requirements. Mr. Svitak, the WWTP Superintendent possesses a Class B certificate. The requirements for obtaining a Class B certificate are as follows:

- Hold a valid "C" certificate in wastewater treatment
- Successfully complete a "B" level examination

- Have a minimum of two years of actual operating experience as an operator of a wastewater treatment plant

Certificates issued by the State must be renewed bi-annually. Currently there are no recertification training requirements in place for re-certification.

3.4 ADEQUACY OF STAFFING

Currently there are nine O&M personnel for the MacDill AFB WWTP. As discussed in Section 3.1, the operators, laboratory technician, industrial mechanics and supervisory staff have other duties related to the lift stations, water booster stations, and swimming pools and in the case of military personnel, training and readiness drills which reduce their total utilization time for plant O&M. Our analysis of these utilization factors indicate that there are the equivalent of seven full-time O&M persons for the plant. Currently the plant operates 16 hours per day. The evening shifts utilize one person each. It appears that the current staffing level is marginally sufficient to properly operate and maintain the facilities assigned under current operating conditions. Improvements in staff utilization could be made by adding additional personnel, possibly a laborer position, especially during swimming pool season. The duties related to disposing of trash from incoming overseas aircraft should be reassigned if possible because of the problem it creates with instantaneous manpower shortages and need at times to leave the plant unattended.

Manpower utilization could also be improved in the area of lift station inspection and reconnaissance. The base recently installed a lift station monitoring system at four of its major lift stations. The hardware senses alarm conditions at the stations such as power failure and high wet well level and transmits data by radio telemetry to a central terminal at the WWTP. The base should consider incremental expansion of this system over time to reduce manpower used in routine lift station visits normally used to ensure that the station is functioning properly.

3.5 ADEQUACY OF EXISTING DOCUMENTS

As discussed in Section 3.2, the WWTP has an O&M manual. This document contains material on the plant as it exists since the upgrade completed in March of 1995. A review of the current O&M manual indicated two areas where improvement is needed. The standard operating procedures are provided in a step-by-step arrangement in which valve and gate sequences are given by number for various operations. The SOP section

of the manual does not, however, have schematic diagrams which indicate the location of the numbered valves and gates. The other problem is similar to the plants' in-house SOPs in that a plant control strategy is not defined. These items will be incorporated into the new O&M manual developed as part of this project. The plant has a complete set of plans available at the WWTP which include the recent upgrade. The plant also maintains a current copy of the reclaimed water permit. The plant has a new flow schematic diagram which shows all current processes and flows. Documents related to the plant maintenance program were not complete. There needs to be a master equipment record kept for each equipment item, a history of repairs/replacements for each item, preventive maintenance schedules and spare parts inventories. The plant maintains a complete set of manufacturer's literature on the new plant and lift station equipment. SOPs available for laboratory analyses are complete for the analyses that the laboratory is running.

The plant had a number of information files on the base-wide safety program. These included safety policy memos issued by the base and squadron commanders, procedures for reporting mishaps and injuries, general safety bulletins, required lists for personal protective equipment, emergency procedures, hazard identification procedures, lockout\tagout guidelines, employee safety and health records, safety briefing records, and a weekly safety inspection checklist. (1.4.1.4)

3.6 EXISTING TRAINING PROGRAMS

All the WWTP operators at some time in their work history at MacDill AFB attend a wastewater treatment course at Pinnellas County Vocational Technical School. Records of this training are kept at the base civilian personnel office. Outside short school attendance is voluntary. Since the State does not require attendance at technical training courses for operator re-certification, there is little incentive or support in this area. Operation and maintenance personnel should be actively encouraged to participate in outside training activities, including state and local operator short school programs. These activities provide an essential source of new ideas, information and the latest developments in the O&M field to the plant staff.

There are no ongoing in-house training programs in wastewater treatment at the MacDill AFB WWTP. In-house training offers operators and supervisors an opportunity on a regular basis to learn new information about the wastewater treatment field and to sharpen their skills in process control, testing, maintenance, etc. In-house training provides an excellent forum for continually keeping relevant operational topics at the

forefront of the staff's awareness. It is recommended that the plant O&M staff develop a plan to have at least a monthly in-house topic, specifically related to MacDill AFB WWTP operations presented to the plant staff by a plant staff member. As mentioned, these types of seminars increase the technical knowledge of the operations staff and provide a forum for discussion of important operational issues at the WWTP.

It is also recommended that the following reference/training manuals be provided at the plant for operators to use for independent study.

- Sacramento Course - *Operation of Wastewater Treatment Plants,* Volumes 1 and 2.
- Sacramento Course - *Industrial Waste Treatment*
- Air Force Manual AFM 91-32 - *Operation and Maintenance of Domestic and Industrial Wastewater Systems*
- Standard Methods for the Examination of Water and Wastewater, 18th Edition
- Manual of Practice OM-9 - Operation and Maintenance of Activated Sludge Plants
- Manual of Practice 7 - Operation and Maintenance of Wastewater Collection Systems
- Manual of Practice OM-3 - Plant Maintenance Program
- Manual of Practice 11 - Operation of Wastewater Treatment Plants
- Manual of Practice OM-1 - Wastewater Sampling for Process and Quality Control

All of the above manuals of practice (MOP) are available from the Water Environment Federation and the Air Force (1.4.1.6).

3.7 MANAGEMENT EVALUATION

The current management structure for the WWTP is adequate to meet the needs of the plant. There is a solid commitment on the part of upper management in the Civil Engineering Squadron and Headquarters of Air Combat Command (HQ/ACC) to making needed improvements to the plant. Funds have been allocated for this Wastewater Treatment Plant Environmental Study by HQ/ACC, and, in addition the plant recently received funding for a major upgrade. The only problem noted is that there appears to be

a lack of cohesiveness on the part of the plant staff with regard to operational strategies for the plant. A mechanism should be implemented whereby plant management meets on a regular basis with the operational staff to discuss operational strategies and issues of concern to the plant operators. At a minimum, weekly staff meetings should be held and as discussed in Section 3.6, in-house training should be utilized.

SECTION 4
PLANT OPERATIONS/PROCESS CONTROL

The MacDill AFB Wastewater Treatment Plant (WWTP) receives primarily domestic wastewater generated at base housing, the hospital, maintenance shops and administrative office buildings located mostly on the eastern half of the Base. Non-domestic wastewaters generated at the maintenance shops and hangers which may contain oils are normally pretreated by oil/water separators to remove floating oils prior to their discharge to the sanitary sewer.

4.1 OVERVIEW OF THE TREATMENT PLANT

4.1.1 Collection System

The collection system for the wastewater treatment plant receives wastewater mostly from the eastern half of the base, the industrial facilities along the flight line and a small portion of the western half of the base. The remainder of the western half of the base, which has fewer facilities and much lower population densities, is served by numerous septic systems and two package wastewater treatment plants. There are also a number of abandoned septic systems and three unserviceable treatment units (package plant, oxidation pond, and sand filter/dosing tank) on the base.

The existing collection system was installed with clay, cast iron, and asbestos/cement pipe. The original clay pipe collection system was installed about 45 years ago and was a combined sanitary and storm sewer system. Since that time, the wastewater collection system has been expanded using asbestos/cement and cast iron pipe. During this expansion period, the storm water system was separated from the sanitary system. All known instances of cross-connection for the two collection systems have now been eliminated, although indications that stormwater is entering the wastewater system were noted during the lift station inspections. Also rainfall versus flow data indicate a pattern related to infiltration and inflow.

As the wastewater collection system has aged, the older pipe has begun to fail. Pipe age ranges from approximately 45 years to one year. The base has maintained a program to upgrade the older pipe and prevent pipe failure. Due to the extent of upgrading, no

given area of the base can be characterized by pipe type or age. The piping upgrades have consisted of replacement of aged pipe with new pipe and the lining of old or weak sections with polyvinyl material. A program to reseal all of the lateral connections to the sewage collection mains has been ongoing for the last eight to nine years. The majority of the infiltration problems have been occurring at the connection points to the mains.

The wastewater collection system consists of gravity flow piping, lift stations, and force mains. The majority of the collection system is gravity flow. The age of the lift stations and force mains ranges from approximately 20 years to less than one year.

Wastewater flows to the 50 wastewater lift stations located throughout the Base. The majority of these lift stations, and all of the seven major lift stations, are located on the eastern half of the Base. Most of these stations function to either collect and pump wastewater from buildings to the gravity system or to "lift" the wastewater back to the gravity system when gravity mains reach the maximum invert. The seven major lift stations pump through a system of force mains that eventually discharge through an 18-inch diameter force main at the WWTP headworks. A separate four-inch diameter force main from the lift stations at the mobile home park also discharges at the WWTP headworks.

Lift stations on the Base range from small, fractional horsepower one-pump (simplex) stations to large triplex submersible pump lift stations with a dedicated emergency power diesel generator and telemetry connections to the WWTP. The Base lift stations are listed in Table 4.1.

Table 4.1 - Lift Stations

NAME/NUMBER	PUMP LAYOUT	LOCATION/COMMENTS
DRMO pkg plant	Simplex	DRMO; 2.8 hp
DRMO pkg plant	Simplex	DRMO; 2.8 hp
DRMO pkg plant	Simplex	DRMO; 2.8 hp
Entomology	Duplex	Entomology; to drainfield
Hanger 4	Simplex	Hanger 4
Hospital supply	Duplex	Hospital supply
Hush house	Simplex	Hush house
Hush house	Simplex	Hush house
Hush house	Simplex	Hush house
P8	Simplex	Wash rack

Table 4.1 - Lift Stations (Cont'd)

NAME/NUMBER	PUMP LAYOUT	LOCATION/COMMENTS
Pavillion	Duplex	Pavillion; fam camp area
Pistol range	Duplex	Pistol range
Zone 1	Simplex	NW corner of Base (zone 1)
21	Triplex	Across from boq; generator
22	Duplex	Redcom parking lot; bar screen
39	Duplex	Flight line, near bldg 48
49	Simplex	Flight line, bldg 49
62	Duplex	Front of hospital
69	Duplex	Flight line (old tower)
70	Simplex	E of bldg 69 on corner of flight line
73	Duplex	Marina trailer park
78	Duplex	Adjacent to JCSE (ammo area)
86	Duplex	Inside radar site
185	Duplex	Flight line
194	Duplex	Flight line
354	Simplex	Next to housing referral
518	Simplex	Flight line wash rack; o/w separator
552	Simplex	Flight line; o/w separator
610	Duplex	Front of bldg. 717
633	Duplex	Enlisted housing area; generator; bar screen
696	Duplex	Next to hospital supply
698	Simplex	Fam camp area
699	Duplex	Golf course club house
705	Duplex	Base mobile home park, west
706	Duplex	Base mobile home park, east
717	Duplex	Bldg 717 near WWTP
718	Duplex	Road to retention pond
822	Duplex	Ammo storage area
844	Duplex	Past sanitary landfill

Table 4.1 - Lift Stations (Cont'd)

NAME/NUMBER	PUMP LAYOUT	LOCATION/COMMENTS
869	Duplex	Officers housing area (20 homes)
932	Duplex	Burger King
970	Duplex	Champus office
1063	Duplex	Flight line behind commissary; o/w separator
1065	Duplex	N or apron taxiway; o/w separator
1144	Simplex	N of apron taxiway; o/w separator
1148	Simplex	Mole hole area
1161	Simplex	North of control tower; to drainfield
1873	Duplex	Fam camp area
1887	Duplex	
2017	Duplex	Marina

The seven major lift stations are visited on a daily basis by two maintenance personnel to ensure proper operation and (if so equipped) to rake the manual bar screen and dispose of the screenings. During the wastewater plant upgrade now being completed, four of the seven major lift stations were connected by telemetry to the plant computer. These stations are now self-monitoring and can instantly report high flow, electrical or pumping malfunctions, or other conditions to the plant computer. When an audible alarm condition is received, the operator may be able to correct the problem through the computer.

Four of the seven major lift stations and seven of the remaining 43 minor lift stations were visited by the evaluation team during the Phase I on-site visit. The three major lift stations not visited were Stations No. 705, No. 706 and No. 718. The condition of the lift stations ranged from good to poor. The major stations visited were all in good condition, with all pumps, controls and alarms in operation and the building interiors and exteriors and surrounding grounds sufficiently maintained. Maintenance personnel reported that the bottom slab in the wet well of Station No. 718 has buckled. This station is scheduled for repair. The manual bar screens in Station No. 22 and Station No. 633 performed their function by collecting rags and debris but presented additional housekeeping problems in

raking and cleanup. During the inspection, small woody twigs were observed on the bar screen of Station No. 633, though there are presumed to be no combined sewers on the Base. The presence of the small twigs may indicate that storm or roof drainage (inflow) may be connected in this service area.

All of the major lift stations have at least two pumps (duplex), with Station No. 21 having three pumps (triplex). With the exception of Station No. 39, all of the former wet pit/dry pit pump configurations have been converted to submersible pumps. All major stations and some minor stations have automatic alternation of the lead and lag pumps. In addition to daily visits at the major lift stations, motor ampere readings are taken on a monthly basis. Most of the active minor lift stations are visited on a weekly basis, while some of the minor stations which receive little, if any, flow are visited on a twice monthly basis.

The Power Production Shop is responsible for the operation and maintenance of the diesel generators located at the WWTP, Station No. 21 and Station No. 633. The remaining five major stations have bypass piping and valves installed so that a portable pump may be used to bypass the lift station in an emergency.

An effort has been made to standardize on motor sizes for the major lift stations, with either 7.5-horsepower or 11.3-horsepower motors used on six of the seven lift stations. Only Station No. 718 is equipped with 15-horsepower motors.

The four major lift stations visited are described as follows:

> **Station No. 21** is located near the intersection of Hillsborough Loop and Tampa Boulevard East and contains three 11.3-horsepower submersible pumps. The station has been converted from a dry pit installation with horizontal centrifugal pumps and a separate wet well to a submersible pump station. The conversion was accomplished by installing the submersible pumps on the dry pit side while retaining the piping connection between the two sides to create a double wet well. The contractor installed the pumps and guide rails incorrectly so that the pumps cannot be vertically removed using the electric hoist located on the floor above. Check valves have been installed in the discharge piping above normal water level but are inaccessible from the stairway. The pumps are controlled by floats which are located along a far wall and are also inaccessible to maintenance personnel. The access stairs have been recently replaced due to corrosion. The

pump station is equipped with audible and visual alarms, a dedicated diesel-powered emergency generator, and is one of the four stations tied to the WWTP through telemetry. The station was in good condition and all equipment was operational. The operator noted that in the past some odor complaints have been received regarding this station.

Station No. 22 is located near the intersection of Poinciana Place and Tampa Boulevard. The 11.3-horsepower, duplex submersible pump station, controlled by floats, was converted from the original duplex, vertical shaft, non-clog centrifugal configuration, with motors at ground level. The pump station is equipped with a manually-cleaned bar screen which the operator accesses by opening a locked hatch and descending a ladder. The bar screen must be raked daily to prevent wastewater from backing up in the gravity line. The screenings are placed in a bucket and hauled up by rope. The ventilation fan runs continuously on the bar screen side of the station. Maintenance personnel report that a check valve is installed on the discharge pipe of each pump, below the water surface. This arrangement requires that the wet well be nearly dewatered for maintenance to be performed. The station is equipped with audible and visual alarms and is also tied by telemetry to the WWTP. All pumps and equipment were operational and station appeared to be in good condition. A hydrocarbon odor was noted during the inspection of this station, which occurs frequently according to the maintenance personnel.

Station No. 62 is located near the Base hospital along Bayshore Drive. This station was previously a dry well/wet well configuration with centrifugal pumps located in a basement connected by vertical shafts to motors located on the ground floor, with an adjacent wet well. The building is now used for storage and to house the telemetry box. During the inspection, two spare rewound 11.3-horsepower motors were being stored in this building. The two submersible 7.5-horsepower pumps are installed in the wet well, and are controlled by floats. The station was clean and well maintained and all equipment was operational. The station is equipped with an interior alarm light and is connected to the WWTP through telemetry.

Station No. 633 is located between the Bridges Loop and Bayshore Drive. The station was converted from a vertical shaft, submerged centrifugal pump with exposed motor (similar to Station No. 22) to a duplex, 7.5-horsepower submersible pump station, controlled by floats. This station is equipped with a

manually-cleaned bar screen set back from the hatch opening, which forces the operator to enter and daily rake the bar screen in a stooped position. At the time of the inspection, small woody twigs were noted in the screenings. This station is connected to the WWTP through telemetry and was in good condition, with all alarms and equipment operable. A diesel-powered generator, dedicated to this station, was located adjacent to the station. The station and generator are enclosed by a fenced area with a locked gate.

Seven of the minor lift stations were also inspected, with comments on these as follows:

Station No. 78 is located on Marina Drive between Building 79 and Building 89. The duplex submersible lift station had a distinct odor of hydrocarbons when inspected and a noticeable sheen on the water in the wet well. The station was in good condition, equipped with both an alarm horn and light and all equipment was operational.

Station No. 49 was not numbered but was located directly southeast of Building 49 on Short Cut Road. This station consisted of one small submersible pump set in a plastic sump sunk into the ground with a large piece of plywood laid over the sump as a cover. The pump appeared to be hard-wired and electrical wiring was exposed at the connection to the building. According to the WWTP maintenance personnel, they were unaware of the station's existence until a problem with the station was reported to them. There are no alarms.

Station No. 610 is located in front of Building 717, west of Bayshore Drive near the WWTP. The station is a new duplex submersible station with a separate, covered valve pit and an alarm horn and light. Maintenance personnel were scheduled to install a pipe cross in the discharge line to allow the station to be bypassed in an emergency.

Station No. 39 is located near Building 48 along the South Apron access road. This duplex, vertical shaft, centrifugal pump station had one pump out of service at the time of the site visit. Two new pumps and appurtenances have been ordered to convert this station to duplex submersible pumps. The station was in fair condition.

Station No. 1063 is located near Building 1065 north of the North Apron Taxiway. This duplex submersible station had one pump removed for service at

the time of inspection. The pumps are equipped with explosion proof motors, and when opened, the wet well had a distinct odor of hydrocarbons and a noticeable sheen on the water surface. The original metal hatch hinges had corroded and the hatch had been temporarily replaced with a piece of plywood. The station was equipped with an alarm horn and light and was in fair condition.

Station No. 185 is located near Building 184, south of the North Apron along the Apron Access Road. The duplex submersible station was clean and all equipment was operational. The station was equipped with an alarm horn and light.

Station No. 194 is located near Hangar 2 along the Apron Access Road. This duplex submersible station was clean and in good condition, with no scum visible in the wet well. The station was equipped with an alarm light and horn.

4.1.2 Oil/Water Separators

Oil/water separators are designed to remove lighter-than-water substances such as oil, fuel, and grease from various wastewater discharges. The oily phase is skimmed from the water surface and accumulates in s sump associated with each oil/water separator for periodic pick-up and disposal by a private contractor. Other heavier-than-water or dissolved contaminants potentially present in the water discharged to an oil/water separator, such as solvents, cannot be removed by this process. The water phase from the separators is then discharged to the base sanitary sewer system, or in the case of the isolated separators, the discharge goes to the storm drainage system, and is not treated further. This storm drainage eventually discharges into the bay. Thirty -nine oil/water separators, seven of which are known to discharge to the storm drainage system, are located on the Base. Base oil/water separators are listed in Table 4.2

Table 4.2 Oil/Water Separators

Facility No.	Facility	Point of Discharge
H-1	Inflight Kitchen	Sanitary Sewer
H-4	Wheel and Tire	Sanitary Sewer
H-4	Propulsion	Sanitary Sewer
8	Fire Truck Maint.	Sanitary Sewer
25	Photo Lab	Sanitary Sewer
33	CE	Sanitary Sewer
178	Transportation	Sanitary Sewer

Table 4.2 Oil/Water Separators (Cont'd)

Facility No.	Facility	Point of Discharge
305	Auto Hobby	Sanitary Sewer
374	Reprographics	Sanitary Sewer
500	Transportation	Drainage Ditch
500	Transportation	Drainage Ditch
518	Aircraft Washrack	Sanitary Sewer
527	Mobile Maint.	Sanitary Sewer
552	AGE	Sanitary Sewer
555	AAFES Service Sta.	Sanitary Sewer
701	37AEG	Sanitary Sewer
847	USCENTCOM	Sanitary Sewer
847	USSOCOM	Sanitary Sewer
847	USSOCOM	Sanitary Sewer
860	JCSE Washrack	Sanitary Sewer
862	JCSE	Sanitary Sewer
864	Pest. Washrack	Drainage Ditch
1050	Harvest Eagle	Drainage Ditch
1051	Fuels Mobility	Unknown
1051	Fuels Mobility	Unknown
1061	Fuel Truck Maint.	Unknown
1065	Corrosion Cont.	Sanitary Sewer
1070	Hydrazine Bldg.	Drainage Ditch
1071	Fuels Barn	Sanitary Sewer
1119	Fuels Storage	Drainage Ditch
1121	Fuels Storage	Drainage Ditch
1144	Asbestos Office	Unknown
1152	Wash Area	Unknown
1188	Fire Training Pit	Sanitary Sewer
1194	Hush House	Sanitary Sewer
1195/1153	Hush House	Sanitary Sewer
1886	290 JCSS	Sanitary Sewer
1886	290 JCSS	Sanitary Sewer
1886	290 JCSS	Sanitary Sewer

Two oil/water separators were visited during the site inspection, with comments as follows:

> **Facility Station No. 552** is located at the Washracks at the southeast end of the North Apron. This station collects washwater from the adjacent building and discharges into the oil/water separator. When inspected, it was evident that Station No. 552 had recently experienced excessive inflow. Maintenance personnel indicated that roof drainage flows to the washrack area and during heavy rains can overload the simplex, explosion-proof submersible pump. The interior of the station had a black, oily coating. The associated aboveground oil/water separator located north of Station No. 552 was inspected and the interior synthetic packing was found to be in disarray.
>
> **Facility Station No. 518** is located at the northeast end of the North Apron at the washrack area. This simplex submersible station serves the integral oil/water separator and was in fair condition. At the time of inspection, clear water was overflowing the weir, although no operations were occurring in the area.

4.1.3 Preliminary Treatment

4.1.3.1 Influent Screening

Raw wastewater enters the treatment plant headworks through an 18-inch diameter force main from satellite lift stations and a 4-inch diameter force main from the lift stations at the mobile home park. Influent flows through a mechanical fine screen located in one influent channel or though a parallel channel which is normally closed by shear gates. This unused channel was previously a grit channel, with a grit channel dewatering pump located on the dividing wall. The hydraulic powered screen has a rated capacity of 4.0 mgd and is designed to be self-cleaning and remove materials larger than 1/4-inch diameter from the influent flow. Screenings are washed into a hydraulic powered trough and screw conveyor assembly which conveys the solids into a 30-gallon garbage can placed under the screw conveyor discharge. The screw conveyor has a rated capacity of 14.1 cubic feet per hour. The screen automatically operates based on a timer or on high channel level, or can be run manually using a local HAND-OFF-AUTO switch. High channel level is sensed by an upstream ultrasonic level controller. Maintenance personnel noted that the timer had been replaced once, under warranty, since the unit was installed less than six months ago.

The screen appeared to be very effective in removing solids from the influent flow and the operators have been pleased with its performance. Maintenance personnel have built a wooden platform which straddles the influent channel to access the inspection panel of the unit and have installed automatic greasing units on the grease fittings. The problem with the existing system is that once the garbage cans become filled with screenings, the operator must attach an electric hoist to the garbage cans, lower them into the back of a truck at ground level and then empty them by hand into a refuse dumpster. The potential exists for injury to the operator if the handle on the garbage can should break during lifting or while handling the cans to empty them, in addition to the physical strain of lifting. Also, the open cans present odor and insect problems and water leaking from the cans present odor and housekeeping problems. To eliminate the current practice, an additional means of horizontal conveyance is required to move the screenings to a collection point beyond the headworks structure. The Civil Engineering Squadron is currently developing plans to address this problem, as it applies both to screenings removal and grit removal.

4.1.3.2 Influent Flow Metering and Sampling

Downstream of the influent screen, flow enters the 12-inch wide Parshall flume, which has a measurement range of 0.078 mgd to 10.4 mgd. The differential water level is transmitted by a stilling well/float system to the adjacent flow meter. The flow signal is transmitted to a 24-hour chart recorder and totalizer in the WWTP laboratory. The approach flow conditions to the flume were not ideal but likely do not affect the accuracy of the flow measurement.

According to plant personnel, the meter is calibrated annually. A yard stick calibrated in tenths of a foot should also be used in conjunction with readily available Parshall flume tables to spot-check the flow readings. A non-refrigerated, composite, portable influent sampler obtains samples downstream of the Parshall flume. Ice is used to cool the sample container when the required bi-weekly influent sample is obtained. The sampler in normally run every other Monday, with samples obtained on a timed basis. A refrigerated sampler would maintain the sample temperature more consistently than ice, but the initial capital expenditure should be considered when compared to the required sampling frequency. The existing FDEP permit for the plant requires a bi-weekly flow-proportioned composite influent sample for CBOD5. To comply with the permit, either the influent composite sampler has be provided with a flow signal or a sampling program has to be initiated which is in conformance with the FDEP definition

final clarifier skimmings through an 8-inch pipe. The equalization basin dampens the fluctuating hydraulic and organic loadings on downstream processes at the plant. The equalization basin is 61 feet wide by 61 feet long and 12 feet deep with an approximate usable capacity of 250,500 gallons at a maximum sidewater depth of 9 feet. A minimum water depth of 3.75 feet is maintained in the basin to keep the diffusers and main pump station suction line submerged, leaving a capacity of 146,100 gallons available for equalization. The equalization basin is equipped with two 300 scfm rotary positive displacement blowers for aeration and mixing through a system of air headers, laterals and coarse bubble diffusers. The bottom of the air laterals are located 2 feet above the bottom of the basin. The blowers are manually controlled through locally mounted ON/OFF controls. The equalization basin is connected to the main pump station by an 18-inch pipe. Float switches in the main pump station wet well control the level in the equalization basin. Operations personnel report no problems with the equalization basin and no scum or floatable solids were evident in the basin during the site visit. The basin has not been dewatered since being placed into service less than 6 months ago, so that an estimate of solids deposition in the basin was not available.

4.1.3.5 Main Pump Station

The main pump station receives both influent from the equalization basin and return activated sludge (RAS) from the three final clarifiers. Influent enters the station wet well through an 18-inch pipe, while RAS flows from three 8-inch telescoping valves through a 6-inch Parshall flume, where it is metered before mixing with the influent. Differential water level is sensed and transmitted by a stilling well/float system to the adjacent flow meter. The RAS flow is metered and recorded on a circular chart recorder located in the plant laboratory.

The main pump station consists of three centrifugal pumps located in a dry well, one dry well sump pump, associated pump controls, three 7.5-HP two speed motors and seven float switches located in the adjacent wet well. The motors are located on top of the structure, connected to the pumps by vertical shafts. The pumps are rated for 1,100 gpm at high speed and 400 gpm at low speed, with operation of the pumps controlled by the seven floats in the following sequence: off, #1 low, #2 low, #1 high, #2 high, #3 low and #3 high. The lead/lag/lag lag pump can be selected or the pumps operated manually through the local control panels.

Maintenance personnel have reported no problems with the main pump station since being retrofitted with new pumps and motors. The windings on the covered open drip proof motors may be subject to humidity and salt air corrosion over the long term. Also, the runs of flexible conduit laid between the motors and local control panels present trip hazards and a possible violation of the 1993 National Electric Code (NEC). The NEC prohibits the use of flexible metallic conduit where it is subject to physical damage.

4.1.4 Aeration Basins

The mixture of raw influent and RAS flows from the main pump station to the two aeration basins through a 14-inch pipe that tees into two 12-inch pipes, which each then discharge near the bottom of each basin. The basins provide biological treatment of the organic wastes. Each aeration basin is 46 feet in diameter with a normal sidewater depth of 12 feet, for a total capacity of approximately 300,000 gallons. The basins have recently been equipped with an aeration system consisting of two rotary positive displacement blowers rated at 800 scfm each, a 6-inch main air header, 2 1/2-inch air laterals and fine bubble air diffusers. Normally only one blower is operated. The aeration pattern appeared to be uniform, but overflow of the weirs indicated level problems in several areas of both basins. Two butterfly valves in the air header can be closed to isolate either basin. Air flow is controlled by a 2-inch bleed-off valve and vertical riser on the main air header. Plant personnel have reported no problems with the aeration system. The method of air flow control, using a bleed off valve and no airflow meter, is a less than exact means of controlling airflow to the basins. The combined noise from the operating blower and the bleed-off line is excessive in the vicinity of the aeration basins.

Effluent overflows a circular weir around the inside of each basin, collects in a launder and flows by gravity through a 14-inch pipe from each basin. The two 14-inch pipes combine into an 18-inch pipe which leads to the final clarifiers.

The current loading rates based on average data from January 1994 - February 1995 to the system are as follows:

Volumetric organic loading	13.3 lbs. BOD/1000ft3
Hydraulic retention time	12.7 hours
Food to microorganism (f/m)ratio	0.13 lbs BOD/lb MLSS

of a flow-proportioned composite sample. If possible, the adjacent influent flow meter should be configured to provide a flow signal to the sampler, which already has an input jack for this purpose.

After the influent sampling point, influent flows through a manual bar screen to the grit removal system.

4.1.3.3 Grit Removal

The grit system and flow equalization basin can be bypassed if required, by operating the appropriate knife gate valves. Influent flow normally enters the 4.0 mgd capacity grit removal system through an 18-inch pipe. In an 8-foot diameter circular steel tank, a motorized impeller is designed to impart both an elevating force to keep lighter solids in suspension and a clockwise flow rotation. The heavier grit settles to a center well and, based on a timer setting, is pumped to an adjacent vortex grit concentrator and inclined screw grit classifier. Water that is removed is returned to the influent flow stream upstream of the grit removal system, while dewatered grit is conveyed by the screw classifier into a 30-gallon garbage can.

The grit removal system appears to be operating well, based on visual evidence of the amount of grit collected. It is not known how well the system is performing. This would require sampling and testing to see what percentage of grit (classified by mesh) introduced to the system is actually captured. Operations personnel have reported no problems with the operation of the grit removal system.

Unlike the screenings collection and disposal, grit-filled garbage cans must be physically dragged by the operators approximately thirty feet over grating and concrete walkway to the electric hoist at the screenings conveyor. Here they are lowered and emptied using the same procedure as for the screenings cans. Operators cannot allow the cans to fill completely or they become too heavy to drag. In addition to the housekeeping, odor and insect concerns, this situation introduces a great chance of operator injury. The problem was recognized prior to the Phase I visit and is being addressed by the CES. A temporary alternative to dragging the cans would be to move them using a two-wheeled hand cart with a strap securing the can to the cart.

4.1.3.4 Equalization Basin

Screened and degritted influent wastewater flows through an 18-inch pipe to the aerated equalization basin, which also receives both tertiary filter backwash water and

The volumetric organic loading rate is below the lower end of the recommended range for conventional activated sludge systems (i.e., 20 to 40 lb BOD/1000 ft3). Similarly, the F/M ratio is below the lower end of the recommended range for conventional activated sludge plants (i.e., 0.2-0.4 lb BOD/lb MLVSS). The Hydraulic Retention Time exceeds the recommended range for conventional plants (4-8 hours): None of these loading factors are in a problem range as far as treatment efficiency or plant performance. However, these numbers are based on average data. There were periods during 1994 when the MLSS was less than 1,000 mg/l which is inadequate to treat even the dilute influent normally entering this facility.

4.1.4.1 Control Strategy

The primary process control strategy which had been utilized at the MacDill AFB prior to the Phase I on-site visit appears to have been the maintenance of a constant mixed liquor suspended solids. Through operator interviews, it was determined that plant personnel have attempted to maintain approximately 2,000 mg/l MLSS in the aeration basins. In reviewing MLSS data for the previous 14 months, there was little consistency in this parameter. It is recommended that the WWTP adopt a different process control strategy. This strategy was discussed with plant personnel during the Phase I evaluation. The proposed strategy is wasting sludge to maintain a constant sludge retention time (SRT). Using SRT as the main process control tool allows operators to waste sludge in a logical manner. SRT expresses the average time that the microorganisms spend in the activated sludge system. It is important that the proper SRT is selected because SRT determines the types of microorganisms that predominate in the system which relates directly to the degree of treatment which will occur. For the MacDill AFB WWTP, a seven day SRT will be used initially. Seven days has been established as the optimum SRT after reviewing the engineering report produced for the upgrade. A SRT of seven days should produce a quality secondary effluent at the MacDill AFB which is a requirement of the discharge permit.

Following is the methodology for wasting the appropriate quantity and volume of activated sludge to maintain a 7 day SRT. This methodology has already been discussed with the plant staff and plans are underway to initiate this control strategy.

1. Calculate the volume of sludge to be wasted each day. The formula to accomplish this is:

$$\frac{\text{Solids Inventory in the Activated Sludge System}}{\text{Desired SRT X WAS Conc, mg / L x 8.34 lbs / gal}}$$

2. Determine the solids inventory in the activated sludge system. This is a three step process

   a. lbs of solids in aeration = MLSS, mg/l X 0.3MG X 8.34 lbs/gal.

   b. lbs of solids in clarifiers = Avg. solids, mg/l X Sludge vol. MG X 8.34

Where: $$\frac{\text{Avg solids, mg / l = MLSS, Conc mg / l + RAS Conc, mg / l}}{2}$$

   Sludge vol, MG=Sludge Blanket, ft X Clarifier Area, ft2 X 7.48gal/ft3

   c. Sum the pounds of solids in aeration and the pounds of solids in the clarifiers to obtain the total solids inventory in the activated sludge system. Another strategy for calculating the total solids inventory is to establish a return sludge pumping rate that results in minimal sludge blankets and assume zero inventory in the clarifiers. This strategy simplifies the calculation and data needed and also assures that sludge blanket losses are avoided.

3. Convert the pounds of solids to be wasted each day into gallons.

$$\text{WAS, gallons} = \frac{\text{Solids inventory in Activated Sludge System X 1,000,000}}{\text{Desired SRT X WAS conc, mg / L X 8.34 lbs / gal}}$$

4.1.4.2 Dissolved Oxygen Control

Dissolved oxygen (D.O.) is another critical process parameter which must be monitored and controlled to the greatest extent possible. D.O. should be monitored in each aeration basin during each shift. The basin D.O.s should never be allowed to drop below 2.0 mg/l. The minimum D.O. requirement of 2.0 mg/l applies to all segments and depths of the basins. To ensure that D.O. is consistent throughout the basins, D.O. profiles should be made of each basin once per quarter. Control of D.O. in the basins is limited to adjusting the 2 inch bleed off valve on the air header line. (1.4.1.1)

4.1.5 Final Clarifiers

Effluent from the aeration basins flows to the three rectangular final clarifiers, where the biological solids are settled and either returned to the main pump station or wasted to the anaerobic digesters. Each clarifier is 16 feet wide and 45 feet long with a sidewater depth of 10 feet. The sidewater depth is 2 feet less than the recommended minimum design depth and can have a profound effect on the performance of the clarifiers if other operating and design conditions are less than optimum. Flow over the clarifier weirs during the evaluation indicated level problems, which should be corrected.

The clarifiers use fiberglass flights and plastic chain driven by a 1.0-horsepower motor on the north and center drives and a 0.5-horsepower motor on the south drive. Both units operate continuously. The south drive was noisy during the site visit. The south tank was drained during the site visit and the tank and all internal equipment appeared to be in good condition.

The flights collect solids into the two sumps per clarifier at the east end and collect floatable skimmings at the west end of the clarifier. Skimmings are removed by manually rotating a slotted pipe skimmer, where they flow by gravity to the skimming pump station located south of the clarifiers. Two 3-horsepower 100 gpm submersible pumps, controlled by floats, return the skimmings to the equalization basin. The system appeared to be in good condition and no problems have been reported.

The return sludge is controlled by the three 8-inch telescoping valves, one per clarifier, at the main pump station. The underflow rate for each clarifier is increased or decreased by manually lowering or raising the telescopic valves.

Sludge is wasted to the waste sludge pit by manually opening a valve (one per sump) using a wrench on the floor-stand operator. The two waste sludge (WAS) pumps are new 6-inch double disc pumps driven by 20-horsepower motors, and are manually operated through local START/STOP controls. Each pump is belt driven through a reducing sheave, operates at 750 rpm, and has a capacity of 410 gpm at 25 feet of discharge head. Sludge is normally wasted on a daily basis. The operator opens the appropriate valves and can determine the waste sludge flow rate and total sludge wasted by the WAS transit-time ultrasonic flowmeter located on the discharge line of the waste sludge pumps. The WAS flow is recorded and totalized on a chart recorder in the plant laboratory once the system is fully operational. In the interim, increase in digester level is used to estimate sludge wasting.

WAS flow is a critical component of the constant SRT methodology recommended. Return sludge rates are currently in the range of 25-30 percent of influent flow, which is much less than design recommendations of 50-100 percent. The current range of RAS rates does not adequately control the sludge blanket depth in the clarifiers. At the time of the evaluation, sludge blanket depths were 1 to 2.5 feet, measured by the operators using a sludge blanket finder ("sludge judge"). As discussed, it is a more efficient strategy to minimize sludge blanket depths.

Current available surface area for the three units combined is 2,160 ft2. Current available volume is 161,500 gallons. Operating parameters for the final clarifiers under average flow conditions of 0.60 MGD area as follows:

Surface loading rate	262 gpd/ft2
Solids loading rate	3.6 lb TSS/ft2-d
Hydraulic retention time	6.9 hours

The surface loading rate, hydraulic retention time and the solids loading rate are all within recommended design values.

Clarified effluent overflows weirs at the west end of the clarifiers and flows by gravity through a 24-inch pipe before reducing to a 16-inch pipe to the distribution well in the center of the tertiary filters. Clarifier effluent is not currently being sampled. Clarifier effluent total suspended solids (TSS) and biochemical oxygen demand (BOD) are needed to assess the effectiveness of the activated sludge system. Also secondary effluent TSS data is needed to determine the efficiency of the tertiary filters. In addition, it is a critical process variable in the SRT process control strategy recommended for implementation at this facility. Daily composite samples of the secondary effluent should be initiated and analyzed for TSS.

4.1.6 Tertiary Filters

Final clarifier effluent flows by gravity to the tertiary filters. Flow enters the filters through a 16-inch pipe into the center feedwell/splitler box, through 10-inch pipes to each of six filter cells, each 10.5 feet in diameter, and across the filter surface. The filters are multi-media units with a total filter bed depth of 4.08 feet. The top layer of filter media, 18 inches of crushed anthracite is on top of 18 inches of graded sand followed by 13 inches of graded gravel. Filter effluent is collected in an underdrain system of perforated

pipe and flows out of the filters through a 10-inch line to the backwash tank. Flows in excess of that required for backwash are discharged into an 18-inch PVC pipe to the chlorine contact tank. Entering each filter bottom is a 3-inch air scour and 8-inch backwash line. During filter backwashing, this 8 inch line is fed from one of two 720 gpm 20-horsepower horizontal centrifugal backwash pumps. Backwash waste exits the filters via the wash troughs and flows to the backwash holding tank. From the backwash holding tank, it is pumped to the equalization basin by one of two 720 gpm, 20-horsepower horizontal centrifugal backwash holding pumps. The air scour system is equipped with one 15-horsepower, 346 scfm positive displacement blower. A small air compressor system supplies air to the pneumatic valves.

Based on an average daily flow of 0.566 mgd and 87 square feet per cell, the loading rate for the filters is 0.75 gpm/ft2. The manufacturers recommended average loading is 2.0 gpm/ft2, with a maximum loading of 5.0 gpm/ft.

The filters have had many mechanical and operational problems since first being installed in 1987. The operators were required to modify the original piping layout of the package unit soon after installation. Also, some pneumatic valves have failed on a regular basis due to their location near the backwash trough. Some of the walkway plates are severely corroded, automatic controls have required numerous repairs, and the air scour piping has several leaks requiring welding repairs. During the evaluation site visit, it was noted that the pump bases for the backwash pumps were badly corroded and that mechanical seals were leaking on the backwash holding pumps. The filter media has been recently replaced.

The evaluation team was informed that a request for welding repairs of the air scour piping was submitted several months ago. At the same time the welders repair the air scour piping, new walkway plates should be installed at the corroded areas and baffle plates may be able to be welded in the backwash trough areas where splashing of the pneumatic valves occurs. The two backwash pump bases and the backwash holding pump mechanical seals require replacement, and spare parts for the automatic filter controls should be kept in stock.

Prior to overflowing a discharge weir at the tertiary filters, filtered effluent flow, pH and turbidity are measured. An ultrasonic flow meter transmits a flow signal to the automatic chlorinator and to the chart recorder and totalizer in the plant laboratory. A pH probe is located in the effluent flow stream and a continuous reading is obtained and

displayed in the laboratory. A continuous filtered effluent turbidity sample is obtained by a sample pump, and pumped to the turbidimeter which transmit a turbidity reading to be displayed and recorded in the plant laboratory. The turbidity sample pump discharges into the aeration basin drainage sump, which is equipped with a signal sump pump discharging into the aeration basin.

The tertiary filters discharge to the chlorine contact tank splitter box through an 18-inch gravity line. Chlorine is added to the effluent flow by a chlorine solution injector/diffuser, located below ground in the 18-inch line.

4.1.7 Chlorine Contact Tank

The chlorine contact tank was constructed during the recent plant expansion to provide sufficient chlorine contact time to meet the high level disinfection requirements for reclaimed water. Chlorine addition and contact was previously accomplished in the tertiary filters, but, over a period of time, corrosion of the structural steel was occurring in the area of the chlorine solution application point.

Flow enters the chlorine contact tank through the splitter box at the east end, where two slide gates with handwheel operators control the flow into two serpentine chambers. Each chamber consists of three channels 5 feet wide and 47 feet long, and with a normal sidewater depth of 5.5 feet, have an approximate capacity of 29,600 gallons. Normally only one chamber is in use at a time. A slide gate controls flow at the west end of each chamber, which overflows into a common effluent pump station wet well. No problems have been reported with the chlorine contact tank or slide gates. A 0.33-horsepower pump at the pump station wet well supplies a chlorinated effluent sample to the locally-mounted chlorine analyzer. The chlorine analyzer, which is several years old, was relocated to the chlorine contact tank during the recent plant expansion. Operations personnel report that the unit is unreliable and have scheduled it for replacement.

The chlorination building contains a chlorine cylinder scale which holds two 150-pound cylinders (one on-line, one on standby), cylinder-mounted vacuum regulators, an automatic switchover unit, a 100 pound per day capacity wall-mounted automatic chlorinator, a chlorine gas detector with battery backup power, a turbidimeter, and a turbidity sample pump. The automatic chlorinator varies the chlorine gas feed rate based upon a flow signal received from the ultrasonic flow meter at the tertiary filters.

The chlorination building is constantly ventilated by a floor level exhaust fan controlled by an inside switch. A self-contained breathing apparatus (SCBA) is stored in a box on the ground, located ten feet away from the building. No inspection window, outside fan switch or external chlorine leak alarm is present at the chlorination building. One of the doors should be replaced with a door containing a window, an outside switch for the building lights and exhaust fan should be installed, and an external leak alarm horn or horn/light combination should be connected to the leak detector.

Although not present at the plant, emergency chlorine gas scrubbers are becoming more common for new chlorine gas installations. Scrubbers are being required in some areas of the country, both on new installations and as retrofits on existing installations, but the state of Florida does not yet require the installation of chlorine gas scrubbers.

4.1.8 Effluent Pump Station

An effluent pump station is located at the west end of the chlorine contact tank, and consists of two 1,600 gpm, 10-horsepower vertical turbine effluent pumps, two 1,000 gpm, 100-horsepower vertical turbine effluent sprayfield pumps and two 800 gpm, 18-horsepower submersible effluent recycle pumps. Normally, effluent which meets reclaimed water standards of total suspended solids, pH and chlorine residual is pumped to the holding pond by the effluent pumps through a 12-inch pipe. If reclaimed water does not meet any of the above quality criteria, the effluent pumps are locked out and the effluent sprayfield pumps pump to the restricted access sprayfields through a 12-inch pipe. In the event that the flow is greater than the capacity of the sprayfield pumps, the effluent recycle pumps return the flow back to the equalization basin through an 8-inch pipe. All three effluent lines are equipped with transit-time ultrasonic flowmeters, which transmit flow signals to a three pen chart recorder and totalizer in the plant laboratory.

The operation of the pumps is based on floats in the wet well and the quality of the effluent, as measured by the turbidimeter, chlorine residual analyzer and pH probe. Only one of the sprayfield pumps is allowed to operate at a time. No problems had been reported with the pumps at the time of the evaluation.

The effluent holding pond has a normal operating depth of 4.5 feet and a capacity of approximately 4 million gallons. At the northwest corner of the pond, a 24-inch pipe connects the pond to an old out of service chlorine contact tank. Two vertical turbine golf course irrigation pumps located in a building at the end of the tank provide water to the north and south golf courses. Two horizontal centrifugal pumps are located in a

separate dry well adjacent to the old chlorine contact tank. These pumps are float operated based on high pond level and pump to the effluent sprayfields.

Four effluent sprayfields with a total area of 82.4 acre, are specified in the current FDEP permit. Of these four sprayfields, only one and one-half are currently usable. The largest sprayfield, No. 1, a wooded area, is not maintained and is out of service due to a broken transmission line and nonfunctional valves and spray heads. Sprayfield No. 2 has been abandoned due to construction of the Florida Air National Guard building and the current construction of a satellite communication facility. Sprayfield No. 3 has a broken transmission line on the north half, the south half can still be used. Sprayfield No. 4, an area contained within a 30.5 acre plot, is used on a consistent basis.

Sprayfield No. 1 should be rehabilitated to a point where it can all be used, and rotated with No. 4 on a regular basis. More attention is needed to existing sprayfield maintenance with respect to mowing of grass, upkeep of the laterals, risers and sprayheads. Consideration should be given to assigning supervision of the maintenance of the sprayfields to the WWTP.

4.1.9 Anaerobic Digesters

Two 40-foot diameter uncovered digesters, with a maximum sidewater depth of 20 feet, are used to partially digest and hold waste sludge prior to being trucked to land disposal by a contractor. Each digester has a capacity of 192,600 gallons, for a total capacity of 385,200 gallons. The primary digester contains a 4-horsepower, 5,400 rpm submersible propeller mixer, which can be raised and lowered by a hand winch from atop the digester, and controlled by a local control panel with START/STOP pushbuttons. The secondary digester is unmixed, and neither digester is heated.

Three sludge pumps are located on the lower level in the building between the two digesters. Two new sludge transfer pumps were installed in the latest plant renovation, and function to load sludge hauling trucks. The two 6-inch double disc, 20-horsepower pumps are rated at 410 gpm and are identical to the waste sludge pumps. A 5-horsepower, 250 gpm vertically mounted centrifugal pump is used for sludge transfer between digesters. An ultrasonic meter is installed on the sludge transfer line between the two digesters, and the flow signal is transmitted to a chart recorder and totalizer in the plant laboratory. The existing sludge drying beds are not used.

Average daily waste activated sludge flow to the digesters was approximately 5,000 gallons during the 14 months prior to the Phase I site visit. Average waste sludge concentration is approximately 3,200 mg/L. Therefore, the current loading factor is approximately 0.005 lb TSS/ft3-d. This loading level is below the design range for an aerobic digesters (i.e., 0.04-0.1 lb VSS/ft3-d). This loading is only an approximation because the waste sludge flow was estimated during this period.

The main problems with the existing sludge system are:

- Little or no volatile solids reduction is being demonstrated by these units. The digesters do not meet the requirements for anaerobic digestion for Class B pathogen reduction required prior to land application of sludge.
- The supernatant line in secondary digester is non-functional because the level of supernatant withdrawal cannot be varied. A new supernatant system should be installed using telescopic valves for liquid withdrawal.
- The sludge transfer pump controls are located in an area surrounded by piping which must be crossed. Provisions should be made for crossing the piping safely to access the controls.
- Sludge must be manually pumped from one digester to another instead of an automatic transfer through overflow piping.
- Process control testing should be performed on the contents of the digesters and all streams around the digester. Data which should be collected regularly includes waste sludge flow, total solids and volatile solids, digester total and volatile solids, withdrawal sludge flow, total and volatile solids.
- As it is currently installed, the flow meter in the digester pipe gallery cannot be used to measure sludge pumped to the waste sludge hauling trucks without piping modifications.

4.1.10 SLUDGE LAND APPLICATION

The MacDill WWTP is permitted to land apply digested sludge at Hudson Farms in Charlotte and DeSoto Counties. As discussed in Section 1 of this report the land application of sludge from the MacDill AFB WWTP appears to be a major compliance deficiency at the present time. Sludge from the MacDill WWTP is processed through two uncovered, unheated digestion tanks. The EPA Part 503 Biosolids Rule and the pending Florida Administrative Code (FAC) Chapter 62-640 Residuals Management

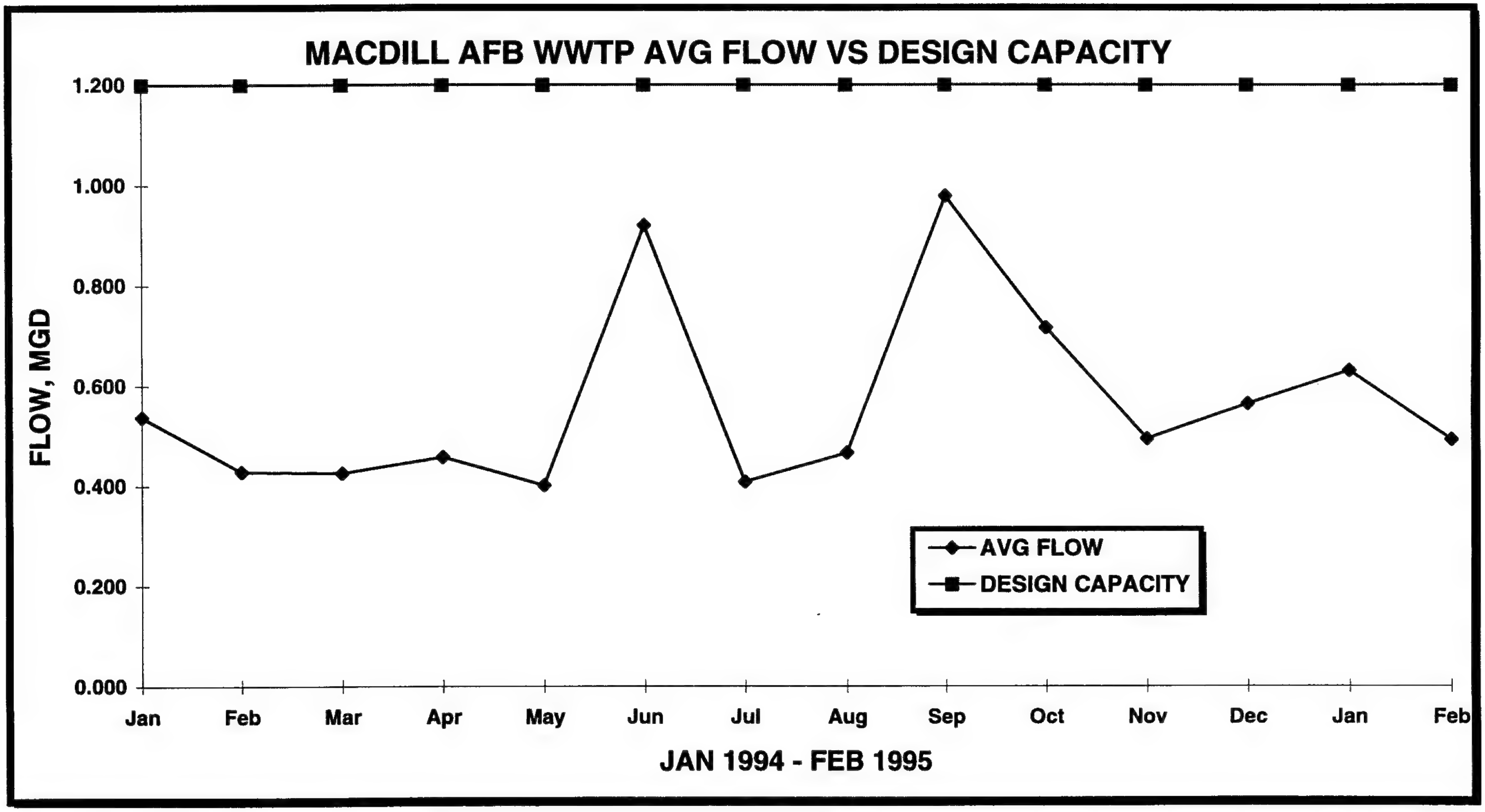
Rules require that biosolids meet pathogen and vector attraction reduction requirements prior to land application. The facility's permit classifies the MacDill WWTP biosolids as stabilization Class B residuals. Under the proposed Florida rules, Class B residuals must undergo treatment in a Process to Significantly Reduce Pathogens (PSRP). The anaerobic digesters at MacDill AFB WWTP do not meet the requirements for a PSRP due to the Mean Cell Residence Time (MCRT) requirements (60 days @ 20°C) or 15 days at 35° - 55°) and temperature requirements. Under 503, Class B pathogen reduction requirements are identical for anaerobic digestion. In addition, under 503 Rules a vector attraction reduction alternative must also be met and it is uncertain, based on available data if the MacDill WWTP could meet any of the available vector attraction alternatives. In addition, EPAs guidance on Anaerobic Digestion as a pathogen reduction technology defines anaerobic digestion as taking place in a covered tank. The fact that the units at MacDill are not covered precludes their being considered as a viable pathogen reduction alternative.

An important aspect of the Part 503 Biosolids Rule that must be kept in mind is that the Rule is self-implementing. Essentially, this means that regardless of whether a permit has been issued by the EPA, the state or local authority, the requirements of the rule are still in force. At present, MacDill AFB is technically in violation of this Federal Rule by land applying sludge that does not meet the requirements discussed above, even though the state or Hillsborough County have not issued their requirements as yet.

4.2 DESCRIPTION OF PLANT PERFORMANCE

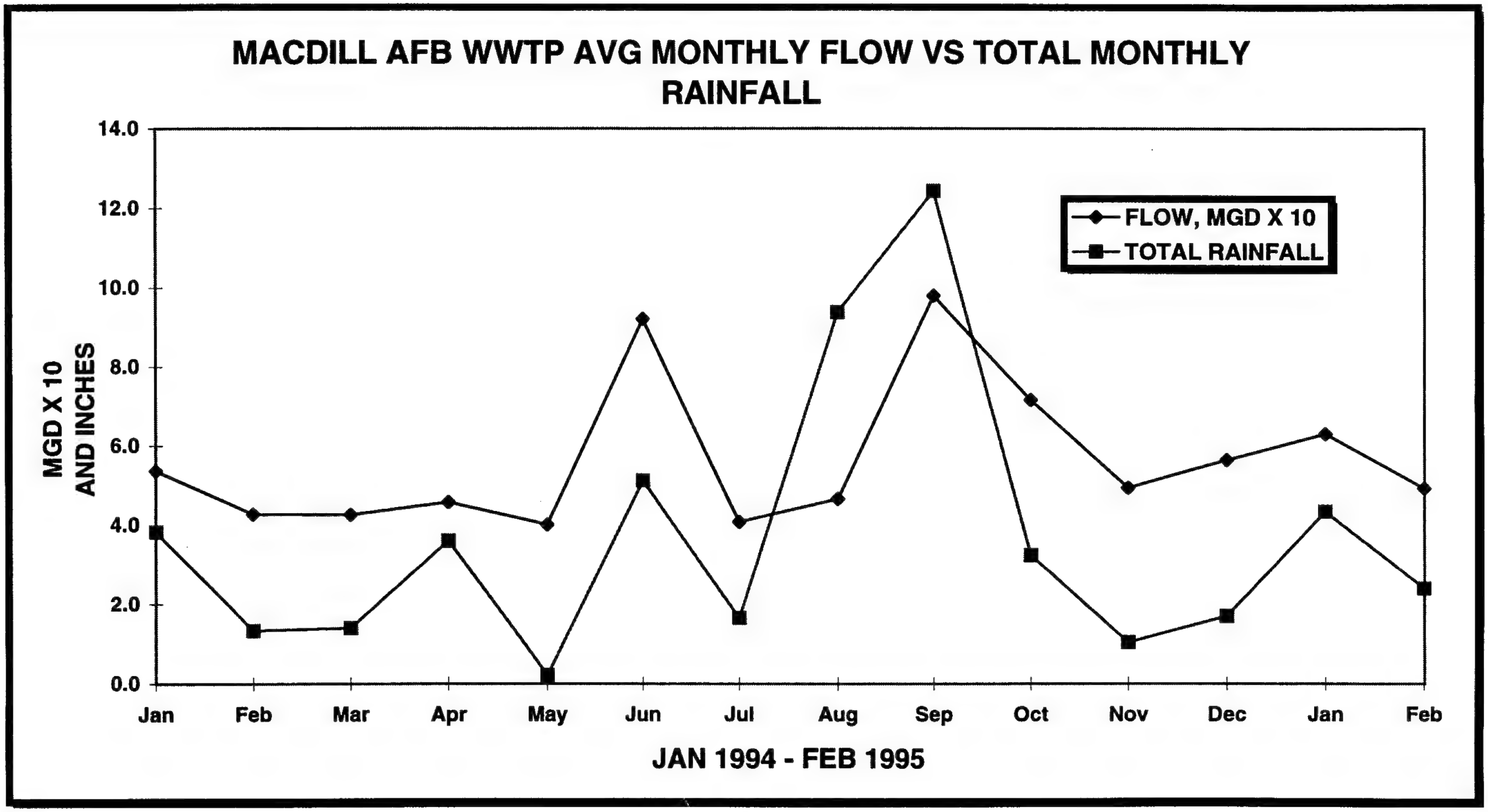
The evaluation team examined plant monitoring reports for the previous 14 months prior to the evaluation to evaluate compliance with permit requirements and design parameters. Overall the performance of the WWTP has been good during this period. There were a total of three instances when the WWTP discharge exceeded a permit limit during the months of January 1994 through February 1995. All of those instances involved the limit for minimum chlorine residual. Figures 4.1 through 4.7 illustrate the monthly average, monthly maximum or monthly minimum discharge values for plant parameters graphed with their respective permit limitations. Figure 4.1 illustrates the average daily flow plotted against the plant average design capacity. The flow data was below the plant capacity on an average basis throughout the period. Furthermore the flow was consistent during the period except during periods of heavy rain in June and September of 1994. Figure 4.2 shows the average flow plotted against total monthly

Figure 4.1



MACDILL AFB WWTP AVG FLOW VS DESIGN CAPACITY
FLOW, MGD
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995
AVG FLOW
DESIGN CAPACITY

Figure 4.2


MACDILL AFB WWTP AVG MONTHLY FLOW VS TOTAL MONTHLY RAINFALL
MGD X 10 AND INCHES
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
FLOW, MGD X 10
TOTAL RAINFALL
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995

rainfall. The graph clearly depicts increases in flow of 80 percent during heavy rainfall periods. This is a Figure 4.1 definite indication of collection system infiltration and/or inflow sources which may need to be investigated and eliminated if cost effective. Figure 4.3 illustrates the monthly average effluent CBOD versus the annual average CBOD permit limit. The CBOD was well within permit limitations throughout the period. Figure 4.4 shows the monthly maximum effluent TSS discharges plotted with the maximum permit limit for reclaimed water. The TSS discharged was also well within its permit limitation. Figure 4.5 illustrates the maximum effluent nitrate levels versus the permit limit during the period. The discharge equaled the permit limit of 12.0 mg/l on three occasions but did not exceed the limit during the period. Figure 4.6 shows the monthly minimum chlorine residual plotted with the permit limitation of 1.0 mg/l. There were three instances as previously discussed in which the minimum discharge was below the permitted minimum. These instances were in June, August and December 1994. These problems were all prior to the completion and initiation of the new chlorination system installed as part of the upgrade. The new chlorination facilities should enhance the disinfection operation and avoid future permit violations. Figure 4.7 illustrates the maximum fecal coliform bacteria discharge versus the permit limitation. The fecal coliform levels were also well within the limits of the permit.

4.3 NON-DOMESTIC DISCHARGES

Based on discussions with plant personnel and maintenance personnel at facilities along the flight line, industrial discharge to the wastewater collection system were limited to oils and greases. The oil/water separators are maintained by a contractor. Since the cessation of air wing activity at MacDill AFB, industrial discharges have essentially ceased. The hydrocarbon odor which was noticed at several lift stations was not further investigated during the Phase I Evaluation.

4.4 SUMMARY OF OPERATIONAL PROBLEMS IDENTIFIED

During the Phase I visit, the evaluation team identified a number of operational problems which have been discussed in Section 4 of this report. The following is a summary of the problems discussed in this section along with recommended improvements.

- Infiltration and inflow problems in the collection system should be investigated and corrected where possible and cost effective.

Figure 4.3

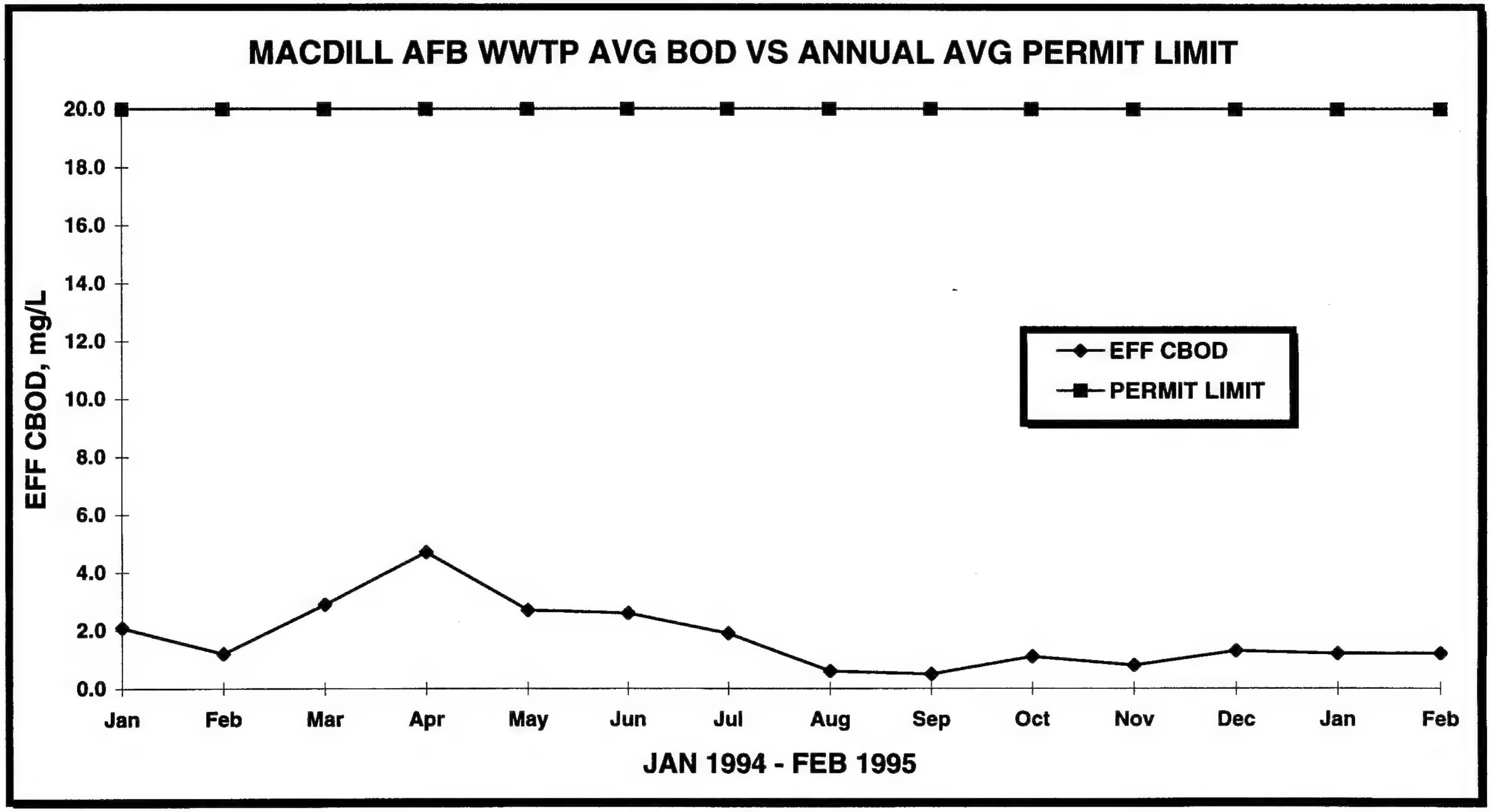

MACDILL AFB WWTP AVG BOD VS ANNUAL AVG PERMIT LIMIT
EFF CBOD, mg/L
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995
EFF CBOD
PERMIT LIMIT

Figure 4.4

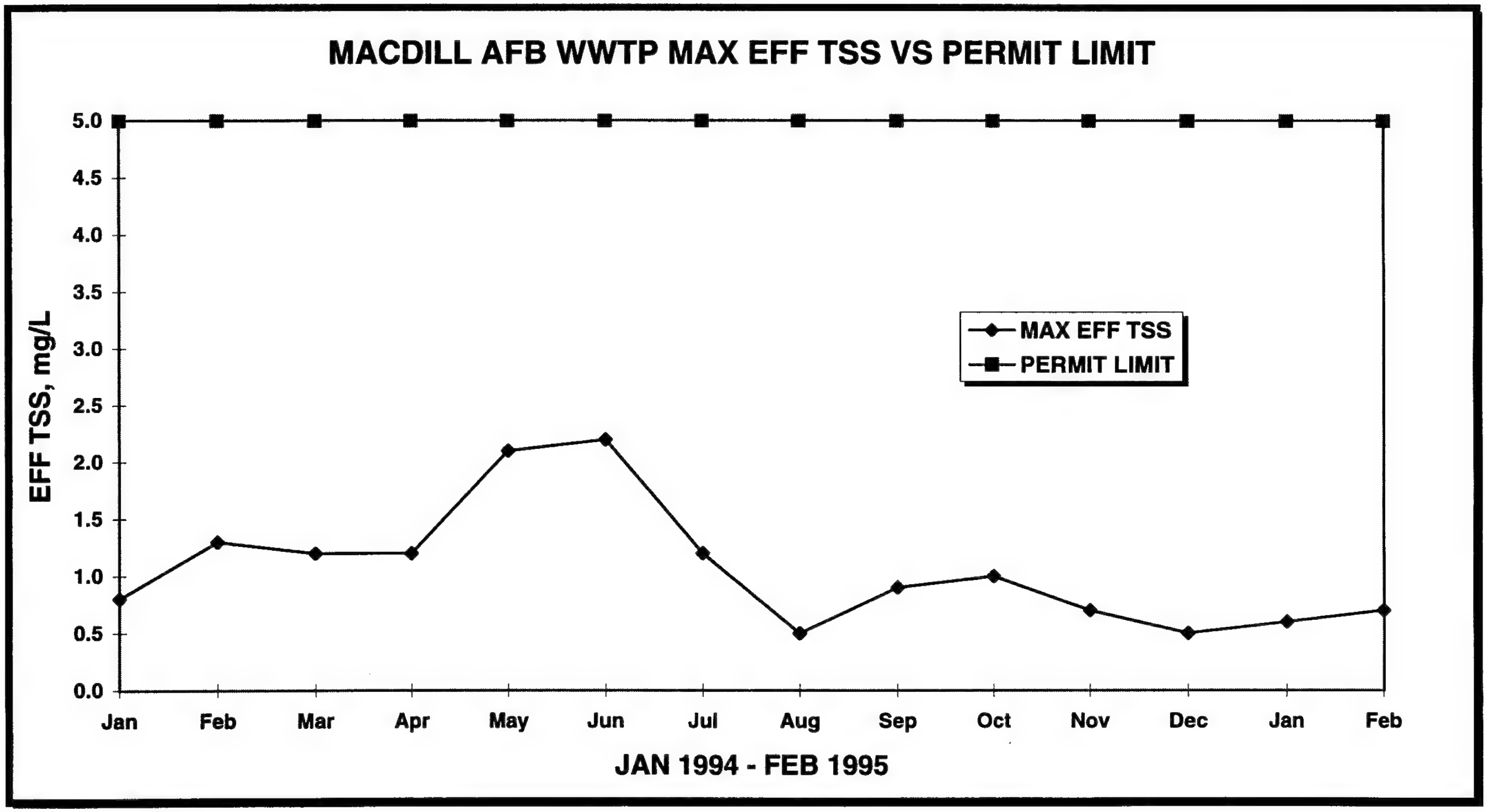

MACDILL AFB WWTP MAX EFF TSS VS PERMIT LIMIT
EFF TSS, mg/L
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
MAX EFF TSS
PERMIT LIMIT
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995

Figure 4.5

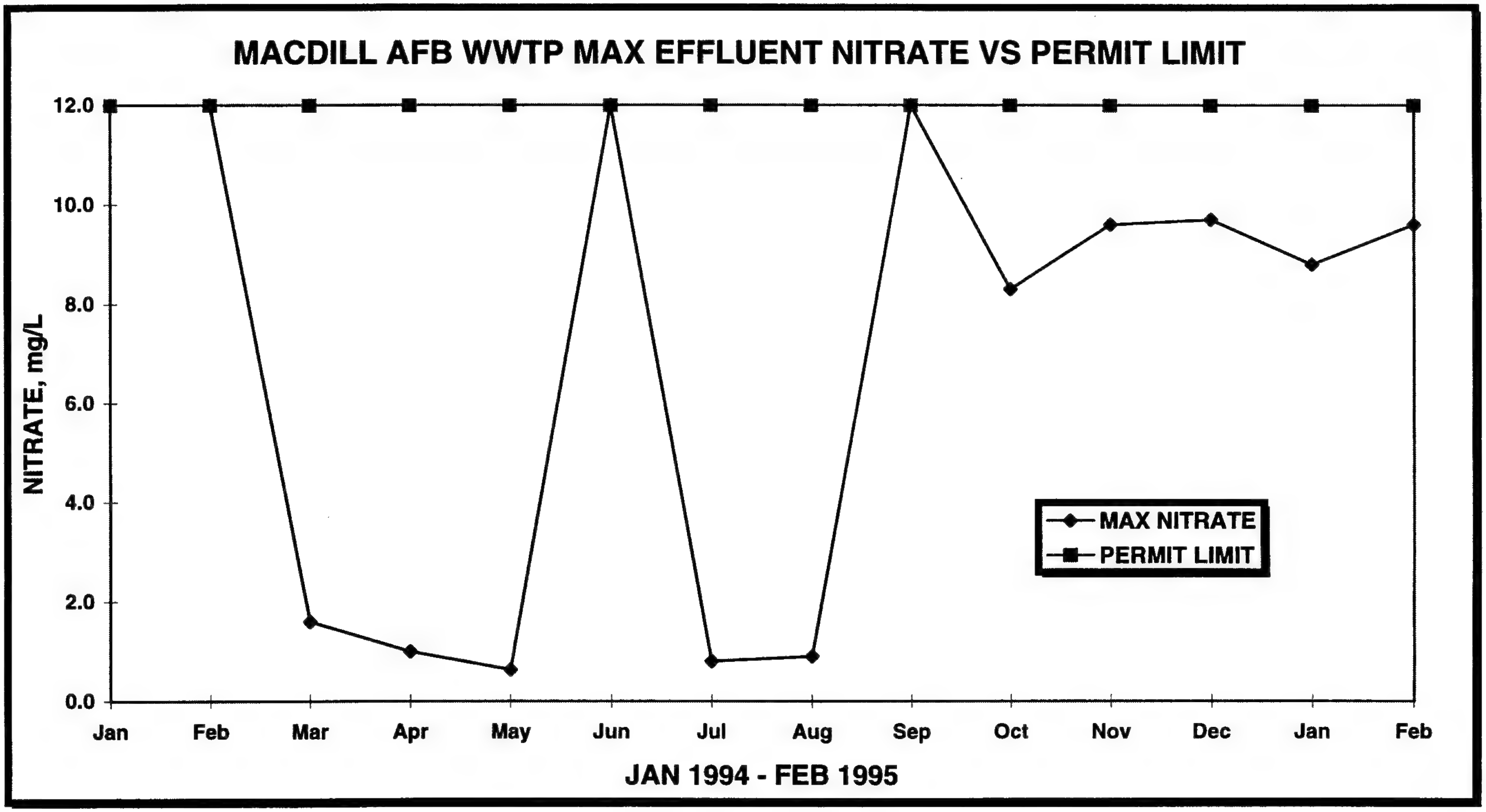

MACDILL AFB WWTP MAX EFFLUENT NITRATE VS PERMIT LIMIT
NITRATE, mg/L
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995
MAX NITRATE
PERMIT LIMIT

Figure 4.6

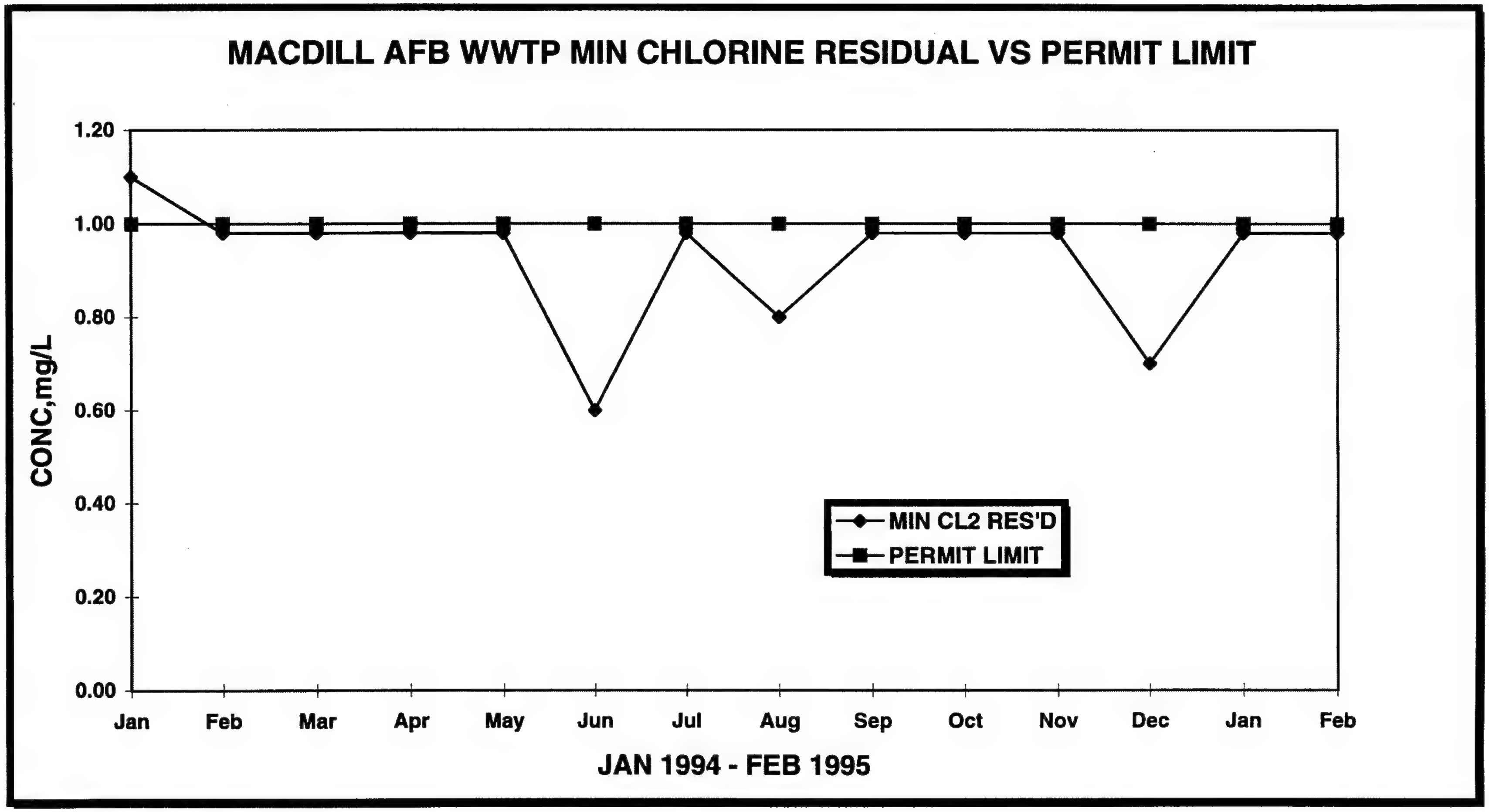
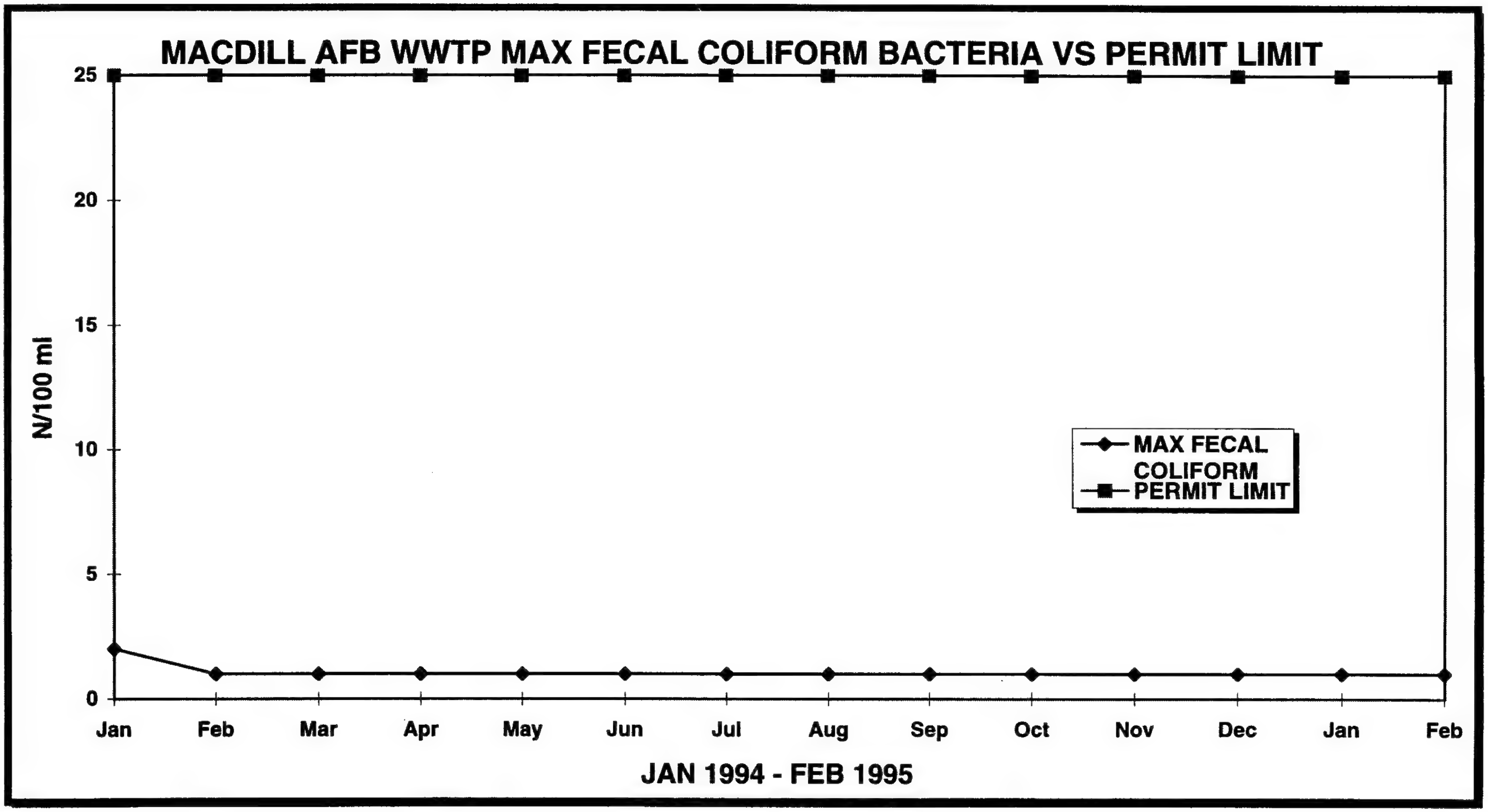

MACDILL AFB WWTP MIN CHLORINE RESIDUAL VS PERMIT LIMIT
CONC,mg/L
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995
MIN CL2 RES'D
PERMIT LIMIT

Figure 4.7


MACDILL AFB WWTP MAX FECAL COLIFORM BACTERIA VS PERMIT LIMIT
N/100 ml
25
20
15
10
5
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
JAN 1994 - FEB 1995
MAX FECAL COLIFORM
PERMIT LIMIT

- The installation of remote monitoring systems for the three remaining major and any critical minor lift stations should be considered. At present, four major lift stations are monitored using this system. Remote monitoring reduces the personnel hours spent on making daily rounds to inspect the stations. Two major stations would continue to need to be visited to rake the manual bars screens if these are kept in service. It is recommended that these screens be removed.
- The oil/water separators and associated lift stations should be closely monitored to prevent oily discharges to the sanitary sewer system. The coalescing pack in the oil water separator at Station No. 552 should be repaired.
- An improved method of transferring screenings and grit directly to a dumpster, without handling by personnel, needs immediate consideration.
- A flow meter connection for both the influent and effluent samplers is required to comply with the existing permit. In lieu of new refrigerated samplers, a base with greater ice capacity could be provided. In addition, a new composite sampler is needed for secondary effluent sampling for BOD and TSS.
- If a performance guarantee is included in the contract documents, and while the grit system is still under warranty, require the manufacturer to sample and test for grit removal efficiencies claimed for the unit.
- The plant influent flow meter calibration should be checked weekly against instantaneous head measurements in the Parshall flume. The meter should be serviced/calibrated twice per year by qualified instrumentation personnel. A contract for calibration of all new plant meters and instrumentation is needed to ensure reliable operation and permit compliance.
- A new DO meter with a 50 foot probe is needed to monitor the aeration basins properly for DO. DO measurements of each basin should be taken once per shift in each basin. In addition, DO profiles of each basin should be made at least quarterly.
- Final clarifier sludge blanket measurements should be taken on each shift and recorded. Return sludge rates should be adjusted to ensure that blanket levels are kept at a minimum.

- The construction contractor should be required to replace the flexible conduit with rigid conduit at the main pump station to prevent tripping hazards and damage to the conduit.

- Weirs in the aeration basins and final clarifiers should be leveled.

- The tertiary filters air scour piping needs to be repaired or replaced. Also, the walkway plates need repair at corroded areas. Diversion plates should be installed to direct backwash flow away from the pneumatic valves.

- The air bleed-off line at the aeration basin blowers should be redirected or muffled.

- As discussed extensively in this section of the report, a process control strategy should be developed for the activated sludge system based on maintaining a constant SRT. Sludge should be wasted daily under this scheme and increased process control testing is required.

- Secondary clarifier TSS data is needed for adequate process control of the activated sludge system and process performance of the filters.

- A new supernatant withdrawal piping system is needed for the secondary anaerobic digester to thicken the digester contents properly and operate the entire solids handling system more efficiently. Telescopic valves should be installed on the secondary digester for this purpose.

- Install an inspection window in the chlorine building. Provide an outside light and fan switch which illuminates when "on". Install an outside alarm horn or horn and light.

- Repair broken sprayfield transmission lines and sprayheads. Require the mowing contracting to mow on a regular basis rather than mowing only when called. All maintenance related contractors working on the sprayfield should report to the wastewater treatment superintendent.

- Strong consideration should be given to rehabilitating Sprayfield No. 1. The remaining area available at fields 3 and 4 appears marginal. Sprayfield No. 4 is shown in Civil Engineering documents to contain 30.5 acres but the actual available acreage within the field is considerably less than 30.5 acres.

SECTION 5
PLANT MAINTENANCE

5.1 CONDITION OF EQUIPMENT AND HOUSEKEEPING

Equipment maintenance at the lift stations and WWTP, maintenance logs, equipment records, housekeeping, and procurement practices were evaluated during the Phase I site visit.

Construction and new equipment installation at the WWTP had been completed prior to the site visit, with only some installation and calibration of instruments remaining. As part of the upgrade, the plant had been repainted and minor mechanical and structural improvements were made to existing facilities. A the time of the site visit, the equipment maintenance and housekeeping at the WWTP and the lift stations was generally good, with the following comments and recommendations:

- The WWTP Construction Contractor should replace the sections of flexible conduit with rigid conduit at the main pump station where it can be physically damaged. This should be a no-cost item for the plant as the current arrangement does not meet the code requirements of NEC.
- The aeration basin blower bleed-off line requires either a muffling device or a 90° redirection towards the retention pond to reduce the noise level.
- Spare parts for frequently replaced items for the tertiary filter controls should be maintained. Manual operation of the filters is time-consuming for operators and during the 8 hours the WWTP is not staffed, poor quality effluent may be produced if the filters are not being operated in the automatic backwash mode.
- Air leaks should be repaired in the tertiary filter air scour piping, or the piping replaced. A maintenance request for welding this piping had already been submitted prior to the site visit.
- Recordkeeping must be improved. The minimum records that should be kept include a master equipment record for each mechanical equipment record item and motors, a record of replacement and repairs, a service record for preventive maintenance items and a record of available spare parts. Currently the WWTP has a computerized radio-telemetry monitoring system for the major lift stations. As part of the software loaded on the monitoring station computer at the WWTP, a maintenance management program is included. This software should be implemented by the Base to establish a fully documented maintenance program. The program software is capable of generating work orders and keeping detailed maintenance records.

- For the secondary anaerobic sludge digester, a new supernatant withdrawal system utilizing a telescoping valve should be installed as soon as possible.

- The effluent sprayfield system requires maintenance with respect to known broken piping and non-functional spray heads. The systems should be tested for integrity and Sprayfield No. 1 and No. 3 rehabilitated and returned to active service.

- Access to the controls for the sludge truck loading pumps needs improvement. To reach the controls mounted along the north digester wall, operators are required to step over discharge piping.

- Consider removing the manual bar screens at Lift Stations No. 22 and No. 633. Although they remove debris from the flow, modern non-clog submersible pumps are designed to pump this debris which would then be removed at the WWTP headworks. The existing situation requires entry into confined spaces with less than ideal conditions. Scum buildup in the wet wells should not increase, and the possibility of a clogged bar screen, and resultant wastewater backup into the gravity sewer, is reduced.

- The remaining three major lift stations or any critical minor lift stations should be equipped with the telemetry system and connected to the WWTP computer.

- It is highly recommended that a service contract be procured for maintenance/calibration of the plant instrumentation. This is especially important for the on-line effluent measurement instruments for chlorine residual, pH, and turbidity. It may be possible to use base resources such as PMEL for this type of service. Also, calibration checks should be performed against lab analysis daily to ensure that the on-line instruments are functioning properly. A great deal of the plant's compliance status relies on this instrumentation.

- Two gaps exist in the perimeter fence along the entrance road to the WWTP. The gate near the drying beds needs to be repaired and secured and the gap in the fence near the new equalization blowers needs to be replaced. Site security for a WWTP is important from both the standpoint of restricting human entry to a potentially hazardous area and restricting entry to a facility which performs a function essential to the health and well being of the service population and the environment. Since the WWTP is only staffed 16 hours per day, a secured site is essential.

5.2 PLANT MAINTENANCE PROGRAM

Preventive maintenance is scheduled for major operating equipment at the WWTP lift stations, and the two package treatment plants. Greasing (where not supplied by the automatic greasers) and oil changes were scheduled for blowers and gear reducers on a monthly basis. The maintenance management system called the Recurring Work Program (RWP) is utilized for the two swimming pools only, for which the WWTP maintenance crew is responsible. A maintenance history of each item that is performed is recorded in a log book, but no record is kept on each item individually, nor are

equipment record cards used. Spare parts are kept on hand but not inventoried. Long lead-time and critical parts, such as submersible pumps and 7.5-HP and 11.3-HP motors for the major lift stations, are kept on hand in addition to smaller submersible pumps, drive belts, valves, etc. Emergency requisitions can be processed on items within several hours time, or less. These items include small submersible simplex pumps, for which there is no inventory maintained. Obtaining required spare parts on a timely basis has not been a problem.

Local shops are used for motor rewinding. Base maintenance vehicles, such as an electric line truck or crane, are available for removal of the larger pumps, motors or equipment.

A complete set of drawings for the WWTP and equipment maintenance manuals for the latest plant expansion are available at the plant site and at the maintenance shop (Building 1205). The manuals provided for the expansion were detailed and fairly complete and will be used by the evaluation team to develop preventative maintenance schedules for the O&M Manual.

SECTION 6
LABORATORY AND SAMPLING PROGRAM

6.1 SAMPLING SCHEDULE

Table 6.1 presents the current sampling and analysis schedule for the MacDill AFB WWTP. The schedule includes samples taken for effluent compliance and for plant process control. The schedule provides a frequency of sampling and analysis for each parameter, as well as where the individual parameter is analyzed. Currently, the majority of the analytical results submitted to Florida Department of Environmental Protection and the Environmental Protection Commission of Hillsborough County for monthly reporting purposes are produced at an outside contract laboratory. In addition, the WWTP laboratory analyzes samples for Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), Mixed Liquor Suspended Solids (MLSS), Total and Volatile solids, Dissolved Oxygen (D.O.), Total Chlorine Residual (TRC), turbidity and pH. The WWTP lab is not certified to run analyses for reporting purposes. The plant is near final completion upon which the effluent pH, chlorine residual and turbidity permit requirements will be met by on-line, continuous monitoring instrumentation. (1.4.1.5).

6.2 LABORATORY PROCEDURES

During the Phase I site visit, the ES evaluation team undertook an evaluation of the laboratory procedures which are performed at the MacDill WWTP laboratory to ensure that process data generated is produced in accordance with approved procedures. The lab technician uses a set of step-by-step procedures for analysis of BOD, TSS, D.O., TRC, pH. These procedures are very thorough and are part of the WWTP laboratory standard operating procedures. Minor comments on the procedures are provided in the following sections. The WWTP is not currently performing analyses of samples for permit required parameters. Nitrate-nitrogen, Fecal Coliform Bacteria, BOD, and total suspended solids are analyzed by an outside laboratory for reporting purposes. It was our understanding that the WWTP does not plan to get certification for any permit required parameters. Also, once all new instrumentation is on-line, effluent pH, total chlorine residual and turbidity will be monitored continuously. Nevertheless, a set of procedures

TABLE 6.1

MacDILL AFB WASTEWATER TREATMENT PLANT SAMPLING/ANALYTICAL SCHEDULE

Parameter	Frequency	Laboratory	Permit Requirement
Influent CBOD	biweekly	WWTP and Contract	Yes
Final Effluent CBOD	1/week	WWTP and Contract	Yes
Influent TSS	biweekly	WWTP and Contract	Yes
Aeration Basin MLSS	Daily	WWTP	
Return Sludge MVSS	Daily	WWTP	
Final Effluent TSS	Daily	WWTP and Contract	Yes
Influent Settleable Solids	Daily	WWTP	
Aeration Basins Settleable Solids (30 min.)	Daily	WWTP	
Return Sludge Settleable Solids (30 min.)	Daily	WWTP	
Final Effluent Settleable Solids	Daily	WWTP	
Filter Dissolved Oxygen (D.O.)	2/week	WWTP	
Final Effluent D.O.	Daily	WWTP	
Aeration Basin D.O.	4/week	WWTP	
Influent pH	Daily	WWTP	
Effluent pH	Continuous	WWTP	Yes
Effluent Chlorine Residual	Continuous	WWTP	Yes
Effluent Nitrate-Nitrogen	1/week	Contract	Yes
Effluent Turbidity	Continuous	WWTP	Yes
Digester Total Solids	1/week	WWTP	
Digester Volatile Solids	1/week	WWTP	
Waste Sludge Total Solids	1/week	WWTP	
Waste Sludge Volatile Solids	1/week	WWTP	
Digested Sludge Nutrients	1/month	Contract	
Digested Sludge Metals	1/month	Contract	
Influent Oil and Grease	2/month	Armstrong Lab	
Influent Oil and Grease	2/month	Armstrong Lab	
Influent COD	1/month	Armstrong Lab	
Effluent COD	1/month	Armstrong Lab	
Influent TKN	1/month	Armstrong Lab	
Effluent TKN	1/month	Armstrong Lab	
Influent Nitrate	1/month	Armstrong Lab	
Influent Orthophosphate	1/month	Armstrong Lab	
Effluent Orthophosphate	1/month	Armstrong Lab	
Influent Sulfate	1/month	Armstrong Lab	
Effluent Sulfate	1/month	Armstrong Lab	
Effluent Fecal Coliform Bacteria	Daily	Contract	Yes

will be included in the O&M manual for these parameters in the event they are needed in the future. (1.4.1.5).

6.2.1 Sampling Procedures

The MacDill AFB WWTP utilizes automatic composite sampling of the influent and effluent for BOD and nitrate-nitrogen. The influent and effluent samples are collected in an equal-volume composite mode. Neither sampler is paced by a flow meter or set up to collect aliquots in inverse proportion to the flow rate as defined by the Florida Administrative Code. Sample collection and sample reservoir containers are plastic. The composite samplers do not have refrigerated compartments to preserve samples during the collection period. The influent and effluent sample locations are representative of the wastewater being treated. The effluent composite sample is being collected after the point of chlorination from the old chlorine contact chamber. Effluent grab samples for chlorine residual and pH are collected at the effluent from the old chlorine contact chamber. Once all new systems are complete pH, chlorine residual and turbidity will be monitored continuously by on-line analyzers. pH and Chlorine will be sampled at the effluent from the new chlorine contact chamber. Turbidity samples are pumped from the filter effluent chamber prior to chlorination. Ice is used to keep the composite samples at 4°C during the sampling period. This presents problems due to the small volume ice compartment within the sampler. Consideration should be given to purchasing refrigerated composite samplers or larger size portable units which can hold sufficient quantities of ice. (1.4.1.5)

6.2.2 Biochemical Oxygen Demand (BOD) (1.4.1.5)

The following minor procedural items were observed with regard to the laboratory analyses for BOD which should be addressed. These items are not considered regulatory deficiencies in that this procedure is not used to generate self-monitoring data but rather items which will optimize the procedure.

1. As mentioned in Section 6.2.1, problems with the sampler size and its ability to hold adequate ice to maintain the composite samples at 4°C during the sample collection period needs to be addressed.

2. Samples collected for BOD analysis after chlorination must be dechlorinated and reseeded. This requires that seed blanks be set up to determine the BOD attributable to the seed material. Alternatively the dilution water can be seeded and BOD attributable to seed determined by seeded dilution water blanks. The

WWTP has a set of laboratory SOPs which contain BOD procedures containing information on seeding BOD dilution water. These procedures should be followed.

3. A standard analysis should be run at least 10 percent of time to insure the accuracy of the analysis for BOD. The two most common standards analyzed for BOD are glucose-glutamic acid and potassium acid phthalate.

4. As is common in many wastewater laboratories, the D.O. depletion in the dilution water blank occasionally exceeds the 0.2 mg/L allowed by the test procedure. The most common reason associated with the problem is insufficient cleaning of glassware, bottles and tubing. All BOD glassware, etc. should be cleaned periodically with chromic acid cleaning solution and thoroughly rinsed prior to usage.

5. Three dilutions are being set up for each sample. The dilutions do not always yield the proper D.O. drop of 2.0 mg/L or the final D.O. criteria of 1.0 mg/L remaining. In those instances, only the dilutions meeting those criteria should be utilized in calculating the BOD value.

6. The bench sheets used for BOD should provide information on the methodology from the latest edition of Standard Methods. (18th Edition currently in use.)

6.2.3 Total Suspended Solids (1.4.1.5)

The following procedural items should be addressed with regard to the TSS analyses to ensure that the SOP adheres to all test requirements and protocols.

1. A thermometer should be inserted into a beaker of sand within the drying oven to ensure that a stabilized temperature reading can be obtained and that the temperature of the drying oven is maintained within the required range of 103°C to 105°C.

2. A temperature log should be maintained of the drying oven temperature.

3. A distilled water blank should be run 10 percent of the time to ensure the precision of the TSS analysis.

4. The bench sheets used for TSS should contain information from the latest edition of Standard Methods (i.e., 18th Edition).

6.2.4 pH

Because the in-lab test methodology will be replaced in the near future by on-line, continuous recording pH analyses, the test methodology was not scrutined during the Phase I Evaluation. Lab analyses of pH should be continued for a check of the on-line instrument.

6.2.5 Turbidity

Turbidity analyses for permit required testing is performed by an on-line turbidimeter. Laboratory turbidity testing should be conducted daily as a check on the on-line instrumentation.

6.2.6 Chlorine Residual

Total Chlorine Residual analyses will be performed by an on-line analyzer. Laboratory TRC testing should continue as a daily check of the on-line instrumentation.

6.3 ADDITIONAL ANALYSES FOR PROCESS CONTROL

Currently, process control testing is being conducted in the WWTP laboratory. The data collected is used sporadically for process decision making. A centralized process control strategy needs to be implemented. It is recommended that the Sludge Retention Time (SRT) method be used to control the plant. The parameters needed to utilize SRT as a control method are as follows:

- Plant Flow
- Aeration Basin Volume
- Waste Activated Sludge Flow
- Aeration Basin Mixed Liquor Suspended Solids (MLSS)
- Return Activated Sludge (RAS) MLSS
- Secondary Clarifier TSS

Four of the six parameters needed are already being collected on a daily basis. Once the problems with the new WAS flow meter are resolved, only the secondary effluent TSS will be lacking. A composite sample of the secondary clarifier effluent should be collected daily and analyzed for total suspended solids.

In addition, the plant should ensure that total and volatile solids analyses are performed consistently on the sludge pumped to the digester, the contents of both digesters and the sludge disposed of to the land application system.

A field D.O. meter with a 50 foot cable/probe should be procured for the lab to run D.O. on the aeration basins. The shorter probe does not allow testing at a variety of depths to ensure adequate D.O. throughout the basins or the running of periodic D.O. profiles of the basins. The operators should be testing for D.O. in each basin on each shift.

SECTION 7
RECORD KEEPING

7.1 EVALUATION OF PLANT RECORDS (1.4.1.3)

During the Phase I visit, the Parsons ES team evaluated the following records:

- Water Pollution Control Plant Operating Logs
- Monthly Operating Reports
- Plant Standard Operating Procedures
- Reuse/Land Application Permits
- Equipment Manufacturers Manuals
- Maintenance Log
- Weekly Safety Checklist
- Plant Log Book
- Laboratory Sampling Records
- Laboratory Procedures and Bench Sheets
- Safety Records
- Plant As-built Drawings

In examining the Water Pollution Control Plant Operating Logs and Discharge Monitoring Reports Logs for the fourteen months prior to the evaluation, some logs were not readily available and the maintenance of these records was somewhat disorganized. Eventually all the logs were found. This points out the need for improved organization in record keeping with regard to plant operating and discharge data. Copies of all the latest permit related records should be kept at the WWTP.

The equipment manufacturer's manuals are kept at the plant and/or the maintenance shop. Information was readily available during the evaluation. The system of vendor's literature was available for easy and quick access. A set of vendors literature for the new

plant equipment was taken by the Parsons ES team to develop PM schedules for the O&M manual. These will be returned at the conclusion of Phase II of the project.

Equipment data records, maintenance history and preventive maintenance schedules are lacking for the most part with regard to WWTP process equipment and lift stations. An Air Force system, known as the Recurring Work Program (RWP), is utilized for the two base swimming pools only. Maintenance history for each equipment item is recorded in a log book but no record is kept on each item individually nor are equipment record cards used. Also, there is not a record kept of the available spare parts on-hand.

It is recommended that at a minimum, records be kept, including a master equipment record for each mechanical equipment item and motor, a record of replacement and repairs, a service record for preventive maintenance items and a record of available spare parts. Currently the WWTP has a computerized radio-telemetry monitoring system for the major lift stations. As part of the software loaded on the monitoring station computer at the WWTP, a maintenance management program is installed. This software should be implemented by the Base to establish a fully documented maintenance program for the WWTP. The program software is capable of generating work orders and keeping detailed maintenance records.

The WWTP currently maintains a chronological logbook for daily activities at the plant. It has been Parsons ES's experience that this is not the best way to keep daily records. We favor use of plant daily operating logs organized by unit process or daily checklists. These systems make it easier to trace the origin of plant and equipment problems. One of the systems should be adopted.

The laboratory records examined were satisfactory for a laboratory producing data for process control parameters. Bench sheet data was being maintained. The Air Force operating logs and monthly reports needed improved organization. A complete set of these records was not available at the plant during the evaluation.

The WWTP had a relatively complete set of as-built plans which are maintained at the control building office.

Safety program record keeping at MacDill AFB WWTP consists of normal AF records. An Employee Safety and Health Record is maintained for each employee on AF Form 55 at the Civilian Personnel Office. AF Form 55 keeps information on employee health, accidents and safety training received. In addition, safety briefing records are

maintained at the WWTP. Safety inspections conducted by the CE Squadron are documented. A WWTP weekly safety inspection checklist is maintained. A more detailed discussion of the WWTP safety program is provided in Section 8 of this report.

SECTION 8
SAFETY

8.1 PLANT SAFETY PROGRAM

The WWTP safety program has a number of provisions for promoting a safe work environment and to prevent accidents. Many of the provisions are part of or an extension of the Air Force's safety program. These provisions include training, procedures and equipment.

Training includes first aid for all civilian employees and both first aid and CPR for military personnel. All new personnel receive hazard communication training (HAZCOM). Weekly safety briefings are performed by the Superintendent of the Wastewater Treatment Plant at the WWTP. Lockout/Tagout program training is required of employees before they're allowed to work on electrical equipment. Most records of safety training are kept on-base in individual AF Form 55. The plant maintains a record for safety briefing topics covered at the plant. The Fire Protection Branch provides initial and periodic training to plant personnel on the use and maintenance of the plant's self contained breathing apparatus located at the WWTP. Records of this training are kept in personnel files.

Safety procedures are based on the AFOSH Safety Standards. A work place hazard analysis of the WWTP and related job tasks has been performed. From this, specific safety procedures have been developed. Procedures for safe handling of chlorine gas cylinders, working around open tanks, chemical handling, working around operating mechanical and electrical equipment are included in the job hazard analysis. A listing of personal protective equipment for employees has also been developed. Each employee has safety items or has access to items such as goggles, gloves, hearing protection, fire extinguishers, eyewash, and self contained breathing apparatus. A procedure and documentation for inspection and maintenance of all respirators in place. A weekly safety checklist is included for the WWTP, lift stations and swimming pool areas. Also, emergency procedures are provided for fire reporting, mishap notification and injury reporting. A procedure is provided to identify and report hazards using AF Form 457, Hazard Report.

Safety equipment located at the plant includes self contained breathing apparatus located at the chlorine feed building. One eyewash is located in the laboratory, there are first aid kits in the lab and control building. Two fire extinguishers are located in the main control buildings. Life rings are located at the headworks (1), the secondary clarifiers (2) and the digesters (2). The plant has a combustible gas/oxygen meter available for safe entry into vaults, wet wells or areas where oxygen could be deficient. This meter is kept on the maintenance truck used for making rounds to the lift stations, etc. (1.4.1.7)

8.2 ADDITIONAL SAFETY NEEDS

Overall, the WWTP safety program was found to be comprehensive and well documented. The following items came to the attention of the Parsons ES evaluation team that need to be addressed:

- Additional fire extinguishers should be procured for the Digester building, the lower level of the control building and the area of the filter control panel and emergency generator.
- An emergency shower/eyewash unit should be installed near the chlorine building. The unit should be mounted away from the door into the chlorine feed room so in the event of personnel contamination with chlorine, flushing of skin can be accomplished safely. The eyewash unit in the lab should be upgraded to include a safety shower.
- Additional life rings are needed at the clarifiers (1), the aeration basins (2), the equalization tank (1), the filters (1) and at each end of the new chlorine contact chamber.
- A guard/barricade is needed at the top of the landing on each aeration basin.
- The shop training material notes the need to use a safety harness when climbing the digester ladder. This equipment was not in evidence during the evaluation.

SECTION 9
CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSIONS

The following conclusions have been reached as a result of the Phase I visit, document reviews and continued communication with WWTP personnel.

1. The plant has a number of excellent programs in place and is generally well operated, the treatment performance during the fourteen months prior to the Phase I evaluation was good. A total of three instances of noncompliance with the permit limitations occurred during this period. New plant equipment and processes installed during the plant upgrade should help to improve the future plant performance.

2. The land application of sludge from the MacDill AFB WWTP appears to be a major compliance deficiency at the present time. Sludge from the MacDill WWTP is processed through two uncovered, unheated digestion tanks. The EPA Part 503 Biosolids Rule and the pending Florida Administrative Code (FAC) Chapter 62-640 Residuals Management Rules require that biosolids meet pathogen and vector attraction reduction requirements prior to land application. The facility's permit classifies the MacDill WWTP biosolids as stabilization Class B residuals. Under the proposed Florida rules, Class B residuals must undergo treatment in a Process to Significantly Reduce Pathogens (PSRP). The anaerobic digesters at MacDill AFB WWTP do not meet the requirements for a PSRP due to the Mean Cell Residence Time (MCRT) requirements (60 days @ 20°C) or 15 days at 35° - 55°) and temperature requirements. Under 503, Class B pathogen reduction requirements are identical for anaerobic digestion. In addition, under 503 Rules a vector attraction reduction alternative must also be met and it is uncertain, based on available data if the MacDill WWTP could meet any of the available vector attraction alternatives. In addition, EPAs guidance on Anaerobic Digestion as a pathogen reduction technology defines anaerobic digestion as taking place in a covered tank. The fact that the units at

MacDill are not covered precludes their being considered as a viable pathogen reduction alternative.

3. The WWTP is currently collecting a good deal of process control data for the activated sludge system but the data is not being utilized in a cohesive strategy to run the plant. A unified control strategy should be implemented for the activated sludge process that is used by all operators. We recommend maintaining a constant sludge retention time (SRT) for control of the process. This strategy, as discussed with plant and base personnel, involves calculating the SRT, utilizing a five-day moving average as a single control point and wasting a calculated volume of sludge every day. The storage, calculation and use of the process control data is best served by utilizing a personal computer (PC) with electronic spreadsheet software. It was indicated during the on-site evaluation that a PC with software would be provided to the plant.

4. The issue of adequate effluent irrigation field area appears to be a major concern due to several irrigation field areas being taken out of service during the past several years. Currently, with the planned elimination of irrigation Field No. 2, only Field No. 4 and part of Field No. 3 remain in service. This could present problems of exceeding the allowable maximum annual hydraulic loading rate of 2.0 inches per week. Also, there are a number of problems in irrigation Field No. 4 with inactive spray heads. These should be repaired to maximize available irrigation area. Strong consideration should be given to renovating Field No. 1 and putting it back into service.

5. There is a need to improve record keeping in the area of maintenance. The minimum records that should be kept include a master equipment record for each mechanical equipment item and motors, a record of replacement and repairs, a service record for preventive maintenance items and a record of available spare parts. Currently the WWTP has a computerized radio-telemetry monitoring system for the major lift station. As part of the software loaded on the monitoring station computer at the WWTP, a maintenance management program is included. This software should be implemented by the base to establish a fully documented maintenance program.

6. The tertiary filter system continues to present operational problems and is in need of repairs. Some of the walk-ways are deteriorated and need replacement plates and welding to improve their integrity. The automatic control system

needs spare parts on hand due to the long lead time experienced with obtaining parts. The air scour piping needs repair or replacement and diversion plates should be installed to protect the pneumatic from splashing.

7. There is a need for on-going operator training. As part of the implementation of the SRT process control strategy discussed above, plant staff should conduct in-house training to ensure all operators and maintenance staff understand the control technology being used and that issues of concern related to plant operation/process control are discussed and understood by all plant staff. The plant should also be supplied with reference/training material such as correspondence courses, manuals of practice and guidance manuals.

8. Once the new WWTP systems go on-line, it is highly recommended that a service contract be procured for maintenance/calibration of the plant instrumentation. This is especially important for the on-line effluent measurement instruments for chlorine residual, pH, and turbidity. Also, calibration checks should be performed against lab analysis daily to ensure that the on-line instruments are functioning properly. A great deal of the plant's compliance status relies on this instrumentation.

9. Additional process testing is needed to adequately operate the digesters. Solids and volatile solids data should be generated weekly at a minimum to determine the efficiency of the units in terms of percent volatile solids reduction. Regular solids testing should be performed on the waste activated sludge pumped to the primary digester, the digester contents, and the sludge withdrawn for disposal.

9.2 RECOMMENDATIONS

Table 9.1 presents recommendations for optimizing operation, maintenance and process control at the WWTP. Broad cost estimates for implementing the recommendations are also included where possible.

Table 9.1. MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
1. MacDill AFB should initiate actions to comply with the EPA Part 503 Biosolids Rule for land applying sludge from the WWTP or pursue other sludge disposal alternatives.	This will probably require an engineering alternatives analysis.	No estimate is available at the present time.
2. The WWTP should develop a unified, consistent approach to process control of the activated sludge system.	Maintaining a constant sludge retention time is a reliable method	None.
3. A computer spreadsheet should be utilized to store, calculate and manipulate process data for maximum results.	Requires a PC and appropriate software at the WWTP	Approximately $2,000 for hardware and software.
4. A detailed, daily operational log should be developed.	Items such as critical plant readings, process test results, samples taken, etc. should be included.	None.
5. The WWTP should have access to one additional position, possibly a laborer position to assist with non-technical plant and lift station duties.	This would be especially helpful during the swimming pool season when operator time is required away from the WWTP.	Approximately $30,000 annually including fringe benefits.
6. Add major and key minor lift stations to the radio telemetry monitoring alarm system incrementally over the next 2-3 years.	Will improve manpower utilization by decreasing routine and unnecessary visits to lift stations. Will also improve lift station operation and reliability.	Approximately $4,000 for hardware and installation per station.

Table 9.1 (Continued). MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
7. Implement maintenance management software currently loaded on computer at the WWTP which is part of the lift station monitoring program.	Will require support from system manufacturer.	Approximately $1,000 for on-site support time.
8. Develop an in-house training program for operators, by operators and supported by WWTP and upper management.	Sharpen knowledge and skills of plant staff.	None.
9. Support operators attending local short courses and operators association meeting.	Florida Water and Pollution Control Operators Association.	$200-$300 per year per operator.
10. Upgrade the plant library of reference/training material.	See Section 3.6	Approximately $250-$300
11. Conduct regular weekly staff meetings at the WWTP to discuss topics related to plant operation and process control.	Create a forum for open discussion of problems and strategies for resolution.	None.
12. Continue base wide efforts to identify and reduce cost effective, correctable sources of infiltration and inflow.	Ongoing basis	Cost unknown.
13. Repair or replace as necessary the coalescing pack in the oil/water separator at Lift Station 552.	Coalescing pack was out of place within seperator and possibly damaged.	Up to $500.
14. Consideration should be given to eliminating the manual bar screens at Lift Stations No.s 22 and 633 to reduce maintenance requirements and hazards associated with confined space entry.	Screenings are handled at plant headwork. Stations contain, modern, non-clog pumps.	In-house labor costs only.

Table 9.1 (Continued). MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
15. Improvement should be considered in the headworks grit and screenings handling systems to improve operator safety and efficiency.	Will require conveying material to headworks hopper which could be used to transfer material to a dumpster below.	Approximately $5,000- $10,000 depending on outcome of current study by the CES.
16. Regular calibration checks should be made of the influent and effluent flow meters using a metal staff gauge or thin yardstick.	Instantaneous head measurements should be taken, converted to flow using standard tables and compared with instantaneous flow readings form the electronic equipment.	Approximately $50 for staff gauge.
17. Begin collecting flow proportional composite samples of the influent and effluent as required by the operating permit.	Will require a signal from the flow meter to the sampler.	Minor internal labor and material costs.
18. A third composite sampler is needed to collect a daily composite sample for process control testing of the secondary clarifier effluent.	This unit does not necessarily need to be capable of providing flow proportioned composite samples but should have a wide ice compartment.	Approximately $1,500 - $2,000.
19. The current samplers need to be replaced at some point with refrigerated units, or if possible provide new bases with compartments capable of holding sufficient ice for preservation.	New bases would be the most economical solution if feasible.	Approximately $500 for new bases.
20. Flexible conduit from the motors to the control panels at the main plant pump station should be replaced with rigid conduit.	The National Electric Code prohibits the use of flexible conduit where it is subject to damage.	Contractor cost.
21. A 50-foot cable/probe for measuring dissolved oxygen in the aeration basins should be purchased.	Allows for measurements at different depths.	Approximately $200.

Table 9.1 (Continued). MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
22. Diversion piping or a silencer should be installed on the aeration header bleed valve to muffle excessive noise.	Route the bleed off air in the direction of the holding pond or install a silencing device.	Approximately $100
23. Conduct D.O. profiles of the aeration basins quarterly and control residual D.O. in the basins at no less than 2.0 mg/L at all locations.	To ensure all parts and depths of basins are D.O. sufficient.	None.
24. Increase the RAS pumping rate to between 50-100 percent of influent flow to maintain a minimal sludge blanket depth.	Blanket depths were approximately 2.5 feet during the evaluation but return sludge was very dark and on the way to being septic.	None.
25. Repair air scour piping leaks in the tertiary filter.	May require replacement of air scour piping.	Unknown until extent of problem is determined.
26. Keep a spare filter control circuit board on hand.	Excessive order time of 3-4 months to get a replacement.	Approximately $2,500
27. Repair tertiary filter walkway plates.	Corrosion problems.	Approximately $500
28. Install splash plates to protect the pneumatic valves near the filter inlet piping. Splash plates will require fabrication.	Valves have had numerous failures due to splashing.	Approximately $500 - $1,000
29. Install an inspection window, light switch and fan switch on the outside of the chlorine building.	Allows operator to illuminate and see conditions inside prior to entering and have control of the exhaust fan from outside.	Approximately $250
30. A study should be undertaken to determine the feasibility of renovating Sprayfield No. 1.	To ensure adequate, long-term sprayfield capacity.	Unknown due to lack of information regarding equipment condition.

Table 9.1 (Continued). MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
31. The current maintenance problems with irregular mowing, broken laterals and out of service sprayheads at Sprayfield No. 4 should be resolved.	This is the primary sprayfield in use at present time.	In-house maintenance costs.
32. The sprayfield maintenance activities should be under the supervision of the WWTP Superintendent since that position has responsibility for WWTP operation and compliance.	Supervisory direction of these activities should be changed.	None.
33. A new supernatant withdrawal system should be installed in the secondary anaerobic digester tank using a telescopic valve.	Will optimize operation of digester and facilitate more economical sludge disposal through sludge thickening.	Approximately \$5,000 - \$7,000 to procure and install.
34. Relocate digested sludge pump controls or provide a walkway to access pump controls.	Controls on north wall are inaccessible except by climbing through and over piping.	Approximately \$500 - \$1,000.
35. Improve digester process control testing for total and volatile solids.	Digester's contents and in and out sludge streams.	None.
36. Replace the mechanical seals on the filter backwash pumps.	Seals are failing and pumps are leaking badly.	Approximately \$200.
37. Replace pump bases for the filter backwash pumps.	Bases are severely corroded.	Approximately \$500.
38. Purchase additional safety equipment items discussed in Section 8.	Safety shower/eyewash unit, fire extinguishers, life rings, etc.	Approximately \$1,000.
39. The use of a safety harness for climbing the digester ladder should be implemented.	Per WWTP safety procedures.	None.
40. Address all deficiencies in procedures for running BOD and TSS as discussed in Section 6.	i.e., reseeding of chlorinated samples.	None.

Table 9.1 (Continued). MacDill AFB Wastewater Treatment Plant Specific Recommendations and Estimated Implementation Costs

Recommendation	Comments/Significance	Estimated Cost of Implementation
41. A service contract for all plant instrumentation maintenance and calibration should be established.	Instrumentation O&M is critical to plant compliance, especially effluent pH, turbidity and CL_2 residual control.	Approximately $3,000/year.
42. Repair gaps in the WWTP perimeter fence discussed in Section 5.	To enhance security of WWTP especially during unattended third shift.	Minor, in-house cost.